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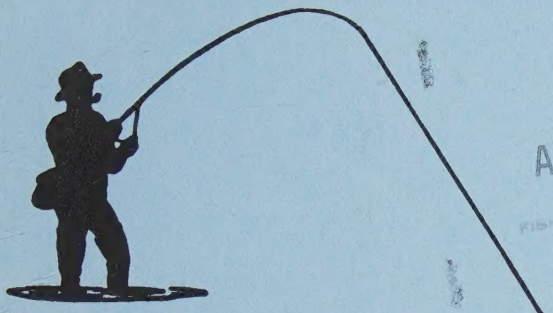

SPORT FISHERY ABSTRACTS

VOL. 20, NO. 3, 1975

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SPORT FISHERY ABSTRACTS

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Sport Fishery Abstracts is intended to furnish fishery biologists with abstracts of current literature in sport fishery research and management.

One volume, consisting of four numbers, is issued each year. Each number contains separate Author, Geographic, and Taxonomic indexes, and the final number of each volume contains cumulative Author, Geographic, Taxonomic, and Subject indexes, and a list of publications screened. Authors who publish in journals not screened for *Sport Fishery Abstracts*, and who would like their publications included, should submit abstracts to the Editor.

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NOTICE

Beginning with this issue, a new format has been adopted for Sport Fishery Abstracts to make it compatible with the computer of the U.S. Department of the Interior Library, Washington, D.C. A modification of the MARIA retrieval system has been used, and the publication will henceforth be computer-generated. Some of the changes in format are as follows:

1. Scientific names will be enclosed in slashes.
2. Diacritical marks will be omitted.
3. Names of all authors will be inverted (last names first).
4. The abstracts will be arranged by subject, rather than randomly as in the past. A table of contents will be included.
5. Each number will have separate Author, Geographic, and Systematic indexes. The Systematic index will be arranged by scientific names.
6. The final number of each volume will have cumulative Author, Geographic, Systematic, and Subject indexes.
7. The five-year index will have cumulative Author, Geographic, Systematic, and Subject indexes, and will repeat citations, but not abstracts.

All problems associated with the new system have not yet been resolved; however, we hope each succeeding number of Sport Fishery Abstracts will incorporate improvements which will aid the user.

The delay in preparation of this number is due in part to problems involved in going to a new system, but is due primarily to vacancies of about nine months in the editorial positions. We plan to be back on schedule very soon.

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Volume 20 Number 3 1976

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AQUATIC PLANTS AND THEIR CONTROL

75-000002 Gerloff, G. C. (Dep. Bot., Univ. Wis., Madison 53706) NUTRITIONAL ECOLOGY OF NUISANCE AQUATIC PLANTS. U.S. EPA, Ecol. Res. Ser. EPA-660/3-75-027. viii + 79p. June 1975. SFA 20(3).

Plant analysis was compared with other frequently used techniques in assays for available nutrients and growth-limiting nutrients in several northern Wisconsin lakes. Data from the different procedures were in poor agreement. The plant analysis bioassay suggested that elements other than P limited plant growth in some of the lakes studied.

As a further development of plant analysis, critical concentrations of a number of elements were established in various macrophytes and algae. The data showed that the critical concentrations for an element can vary greatly in different organisms, so much so that specific critical concentrations must be established for each aquatic species utilized in plant analysis bioassays.

The plant analysis bioassay indicated that K supply, rather than N or P, became limiting for the growth of the macrophytes /Myriophyllum spicatum/ and /Ceratophyllum demersum/ in a shallow eutrophic lake.

Three procedures were developed and tested for evaluating the capacities of macrophytes and algae to compete for nutrients at the low concentrations characteristic of lakes. These procedures involved (1) competition among several organisms in the same culture for a growth-limiting amount of a nutrient, (2) nutrient replacement in cultures to establish the borderline concentration at which an organism failed to make maximum growth even though the total nutrient supply was adequate, and (3) measurement of rates of nutrient uptake and calculation of Vmax and Km values in terms of Michaelis-Menten kinetics. The competitive and uptake capacities of various aquatic plants for a specific element differed markedly.

75-000003 Harrison, P. G.; Mann, K. H. (Zool. Inst., Lab. B., Univ. Aarhus, 8000 Aarhus C, Denmark) CHEMICAL CHANGES DURING THE SEASONAL CYCLE OF GROWTH AND DECAY IN EELGRASS (/ZOSTERA MARINA/) ON THE ATLANTIC COAST OF CANADA. J. Fish. Res. Board Can. 32 (5): 615-621. May 1975. In English with French summ. SFA 20(3).

In a submerged bed of eelgrass, newly formed leaves in winter and spring had their maximum levels of total organic matter (90 percent of dry weight), soluble organic fraction (45 percent), carbon (42 percent), and nitrogen (4.8 percent). These components all decreased as the leaves matured, aged, and died. Soon after death, a leaf had only 70 percent total organic matter, 28 percent soluble organic matter, 30 percent carbon, and 1.5 percent nitrogen. Intact dead leaves showed little further change in chemical composition. The commonly used crude protein determination (6.25 X nitrogen content) overestimated true protein by up to 180 percent. The carbon to nitrogen ratio (C:N) was an unreliable index of the nutritional value of the plant. Two growth forms were present, most probably in response to wave action and substrate composition. Daylength, not temperature, most probably controls the seasonal cycle of growth.

75-000004 Southwick, C. H.; Pine, F. W. (Dep. Pathobiol., Johns Hopkins Univ., Baltimore, MD 21205). ABUNDANCE OF SUBMERGED VASCULAR VEGETATION IN THE RHODE RIVER FROM 1966 TO 1973. Chesapeake Sci. 16 (2): 147-151. June 1975. SFA 20(3).

Surveys on the distribution and abundance of submerged vascular plants in the Rhode River showed that there was an irregular decline in the amount of vegetation from 1966 to 1973, along with signigicant changes in species dominance. In 1966, redheadgrass (/Potamogeton perfoliatus/) and Eurasian watermilfoil (Myriophyllum spicatum/) were both very abundant with lesser amounts of widgeongrass (/Ruppia maritima/), horned pondweed (/Zannichellia palustris/), sago pondweed (/Potamogeton pectinatus/), and elodea (/Elodea canadensis/). In 1967, all of these species declined substantially, and elodea disappeared entirely. In 1968, redheadgrass and horned pondweed returned in substantial abundance, but they again declined in 1969 and virtually all submerged aquatics disappeared in 1970. In 1972, horned pondweed and sago pondweed reached an eight-year peak, but other species remained at very low levels. In 1973, all species were low, and a prominent lack of vegetation similar to 1967, 1970, and 1971 occurred again. Elodea has not been seen in the Rhode River since 1966. We believe these changes represent a decline in environmental quality in the Rhode River that may have serious long-range implications.

GENERAL FISH CULTURE

75-000005 U.S. Fish and Wildlife Service (Washington, D.C. 20240) REPORT OF THE NATIONAL TASK FORCE FOR PUBLIC FISH HATCHERY POLICY. U.S. FWS, Washington, D.C. 295p. 1974. SFA 20(3).

This study determined the numbers, kinds and sizes of fish produced and stocked by state and federal hatcheries in the United States during 1973, and defined appropriate state and federal responsibilities for fish culture. State and federal agencies operated 515 hatcheries, which produced 216 million trout and salmon; 100 million freshwater bass, sunfish, catfish and other warmwater species; 17 million walleye, northern pike and muskellunge, and 6 million striped bass. Production of marine fish was negligible. Management and financial responsibility for stocking inland public fishing waters is seen as a state responsibility; for research and development and anadromous fisheries as a joint responsibility; and for support of state programs, particularly with activities states cannot handle effectively, as a federal responsibility.

TROUT AND SALMON CULTURE

75-000006 Moring, J. A.; Moring, K. A. (Fish. Res. Inst., Univ. Wash., Seattle 98195) SUCCESSION OF NET BIOFOULING MATERIAL AND ITS ROLE IN THE DIET OF PEN-CULTURED CHINOOK SALMON. Prog. Fish-Cult. 37 (1): 27-30. Jan. 1975. SFA 20(3).

Biological fouling material can influence pen-cultured chinook salmon (/Oncorhynchus tshawytscha/) directly and indirectly. A study was undertaken in Clam Bay, Puget Sound, Washington, to assess (a) the changes in volume of material on nets, (b) the species attaching to netting, (c) the succession patterns of invertebrates, and (d) the invertebrates consumed by juvenile chinook salmon in floating, saltwater pens. Volumes of material were greatest at 0.5 m, and

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diatomaceous growth and /Ulva/ spp. dominated the flora. Four groups of invertebrates were significant: Amphipoda, Caprellidea, Polychaeta, and two Mollusca (/Mytilus edulis/ and /Hiatella/ spp.). Seasonal succession patterns of invertebrates were evident on netting. Analysis of stomach of salmon revealed that invertebrates from pen netting play only a minor role in the diets of pen-cultured chinook salmon.

75-000007 Thomas, A. E. (Fish Farming Exp. Sta., U. S. FWS, Stuttgart, AR 72160) EFFECT OF EGG CONCENTRATION IN AN INCUBATION CHANNEL ON SURVIVAL OF CHINOOK SALMON FRY. Trans. Am. Fish. Soc. 104 (2): 335-337. Apr. 1975. SFA 20(3).

Eyed eggs of chinook salmon (/Oncorhynchus tshawytscha/) were planted in the Abernathy (Washington) incubation channel at concentrations of 7,180, 10,764, and 14,349 eggs/m^2 of gravel. Numbers of eggs planted were 200,000, 240,000, and 200,800, and survivals to the downstream migrant stage were 78.5, 85.0, and 79.1 percent, respectively; the differences were not statistically significant. The concentrations of 14,349 eggs/m^2 is near the capacity of the channel. This stocking rate is 10 times that commonly recommended for artificial spawning channels. Egg concentration was apparently limited only by the physical capacity of the gravel.

75-000008 Thomas, A. E. (U.S. FWS, Fish Farming Exp. Sta., Stuttgart, AR 72160) EVALUATION OF THE RETURN OF ADULT CHINOOK SALMON TO THE ABERNATHY INCUBATION CHANNEL. NOAA Fish. Bull. 73 (2): 356-359. Apr. 1975. SFA 20(3).

Adult returns of progeny of the 1964 year class of salmon, /Oncorhynchus tshawytscha/, were determined for the Abernathy incubation channel, natural production, and hatchery sources. A total of 4,620,600 fry were released from the channel into Abernathy Creek (state of Washington) as unmarked fry. Natural production in the creek was estimated from spawning ground counts and fyke net sampling of migrants at 16,700 fry, or 0.36 percent of the total unmarked fish. A total of 557,649 hatchery fish were marked by feeding tetracycline, and 161,579 were both fin-clipped and fed tetracycline. All 2-, 3-, and 4-yr-old adult fish returning to the hatchery holding pond were examined for fin clips and fluorescent bands on the vertebrae. Returns from hatchery sources were 506 fish or 0.070 percent. Potential egg production was 865,000 or 76 percent of the original 1,142,604 eggs. Returns from the channel totaled 733 fish or 0.016 percent. Egg potential was 2,050,000 or 35 percent of the original 5,888,048 eggs. Returns attributed to Abernathy Creek totaled only three fish and egg potential was 0.2 percent of the original 2,880,000 eggs. Survival of this year class was considerably below the 9-yr average of 0.118 percent. Intuitively, costs favor incubation channel production over hatchery procuction. However, additional studies are needed to determine if contributions to the fisheries and survivals are comparable in years of better year class survival.

WARMWATER CULTURE

75-000009 Andrews, J. W.; Matsuda, Y. (P.O. Box 13687, Savannah, GA 31406) THE INFLUENCE OF VARIOUS CULTURE CONDITIONS ON THE OXYGEN CONSUMPTION OF CHANNEL CATFISH. Trans. Am. Fish. Soc. 104 (2): 322-327. Apr. 1975. SFA 20(3).

Several experiments were conducted on relationships between oxygen consumption of channel catfish (/Ictalurus punctatus/) and environmental dissolved oxygen concentrations, feeding status, weight

75-000009 CONTINUED
of fish, and temperature. Estimates of oxygen consumption under culture conditions were obtained by determining the rate of oxygen depletion in a still tank without aeration. Respiratory dependence (decrease in oxygen consumption rate with a decrease in environmental oxygen concentration) in both well-fed and fasted fish was noted at oxygen concentrations between 1 and 7 milligrams/liter. The oxygen consumption rates obtained one hour after feeding were higher than those taken immediately after feeding or from fasted fish. A log-log relationship between oxygen consumption and body weight of fish (2.3-1,006 g) was demonstrated. The slope (b) for the equation, oxygen consumption = (a) (weight) to the b, was 0.80 for both well-fed and fasted fish. The relationship bewteen oxygen consumption and environmental temperature was linear over the range 24-28 C for well-fed fish and 24-30 C for fasted fish. The Q -10's for plots for the well-fed and fasted fish were 1.9 and 2.3, respectively; thus the data were in accord with van't Hoff's Law.

75-000010 Beyerle, G. B. (Mich. Dep. Nat. Resour., Wolf Lake Fish Hatchery, Mattawan 49071) SUMMARY OF ATTEMPTS OF RAISE WALLEYE FRY AND FINGERLINGS ON ARTIFICIAL DIETS, WITH SUGGESTIONS ON NEEDED RESEARCH AND PROCEDURES TO BE USED IN FUTURE TESTS. Prog. Fish-Cult. 37 (2): 103-105. Apr. 1975. SFA 20(3).

Through 1973 no success has been reported with attempts to raise walleye (/Stizostedion vitreum vitreum/) fry on artificial, pelleted diets. Walleye fingerlings have been raised from 2 in. to 4 in. on several types of artificial diets, but success has been limited by a succession of fish cultural problems. Rearing containers, water and fish diseases, light intensity and periodicity, and food and feeding are briefly discussed and suggestions made to improve cultural techniques and diet testing procedures.

75-000011 Burnside, M. C.; Avault, J. W., Jr.; Perry, W. G., Jr. (Woodward-Envicon, Inc., P.O. Box 678 Allwood Station, Clifton, NJ 07012) COMPARISON OF A WILD AND A DOMESTIC STRAIN OF CHANNEL CATFISH GROWN IN BRACKISH WATER. Prog. Fish-Cult. 37 (1): 52-54. Jan. 1975. SFA 20(3).

A domestic strain and a wild strain of channel catfish (/Ictalurus punctatus/) were cultured in brackish water ponds. The domestic strain produced an average of 2,300 kg per hectare, the wild strain 1,835 kg/ha. Mean weight gain per fish was 445 g for domestic fish and 359 g for wild fish. Feed conversion averaged 1.8 for domestic fish and 1.9 for wild fish. Dressing percentage was 57.7 for domestic fish and 56.8 for wild fish. Condition factors (K-sl) were 1.74 for domestic fish and 1.73 for wild fish.

75-000012 Chervinski, J. (Fish Aquaculture Res. Sta., Dor, Israel) SEA BASS, /DICENTRARCHUS LABRAX/ LINNE, (PISCES, SERRANIDAE) A "POLICE-FISH" IN FRESHWATER PONDS AND ITS ADAPTABILITY TO VARIOUS SALINE CONDITIONS. Bamidgeh 26 (4): 110-113. Dec. 1974. SFA 20(3).

Laboratory experiments were conducted to determine the adaptability of /Dicentrarchus labrax/ to various salt concentrations. It was found that the minimum salinity tolerated by young /D. labrax/ on direct transfer is 10 percent sea water (S = 3.9°/oo). Through gradual adaptation the fish withstood salinity as low as 0.5°/co.

Young /D. labrax/, caught on the Mediterranean shore on January-March, 1973, incidentally while fishing gray mullet fry, reached an average size of 341 mm S.L. and an average weight of 680 gram by August 27, 1974.

75-000013 Stanley, J. G.; Martin, J. M.; Jones, J. B. (U.S. FWS, Fish Farming Exp. Stn., Stuttgart, AR 72160) GYNOGENESIS AS A POSSIBLE METHOD FOR PRODUCING MONOSEX GRASS CARP (/CTENOPHARYNGODON IDELLA/). Prog. Fish-Cult. 37 (1): 25-26. Jan. 1975. SFA 20(3).

Artificial gynogenesis was observed in grass carp (/Ctenopharyngodon idella/), Israeli carp (/Cyprinus carpio/), goldfish (/Carassius auratus/), bigmouth buffalo (/Ictiobus cyprinellus/), and black buffalo (/Ictiobus niger/). Yields of less than 2 gynogenetic offspringincrease yields with thermal shocks or pressure.

MARICULTURE

75-000014 Smigielski, A. S. (NMFS, Narragansett Lab., Narragansett, RI 02880) HORMONE-INDUCED SPAWNINGS OF THE SUMMER FLOUNDER AND REARING OF THE LARVAE IN THE LABORATORY. Prog. Fish-Cult. 37 (2): 3-8. Jan. 1975. SFA 20(3).

The capture, transport, and maintenance of adult summer flounder (/Paralichthys dentatus/) in the laboratory is described. Gonadal maturation and spawning was achieved by controlling water temperatures, photoperiod, abundant feedings and administering injections of carp pituitary. Carp pituitary (freeze-dried powder) proved effective in bringing about ovulation and subsequent spawning. Eggs obtained from these hormone-induced spawnings appeared normal, and several larvae were reared through metamorphosis. As far as is known, this is the first reported successful induced spawning of summer flounder and rearing of larvae through metamorphosis in the laboratory.

75-000015 Smigielski, A. S. (NMFS, Narragansett, RI 02882) HORMONAL-INDUCED OVULATION OF THE WINTER FLOUNDER, /PSEUDOPLEURONECTES AMERICANUS/. NOAA Fish. Bull. 73 (2): 431-438. Apr. 1975. SFA 20(3).

The response of winter flounder, /Pseudopleuronectes americanus/, to human chorionic gonadotropin (HCG), oxytocin, pregnant mare serum gonadotropin (PMSG), deoxycorticosterone (DOCA), and freeze-dried carp pituitary is described. HCG and PMS were successful in some instances in producing viable eggs and larvae while carp pituitary was successful in all instances. These were the first known successful attempts to induce maturation and spawning of winter flounder artificially in the laboratory.

Larvae obtained from these hormonal-induced spawnings were normal in all respects and were reared in the laboratory through metamorphosis. Wild plankton obtained from Narragansett Bay, brine shrimp nauplii, and chopped clams were fed as food. The early life history of this flatfish can, for the first time, be completed under controlled laboratory conditions.

FEEDS, FEEDING AND NUTRITION

75-000016 Andrews, J. W.; Page, J. W. (P.O. Box 13687, Savannah, GA 31406) THE EFFECTS OF FREQUENCY OF FEEDING ON CULTURE OF CATFISH. Trans. Am. Fish. Soc. 104 (2): 317-321. Apr. 1975. SFA 20(3).

In three studies on the effects of frequency of feeding on channel catfish (/Ictalurus punctatus/), optimal growth and food efficiency were obtained from groups fed to satiation two times per day. Gains in weight were substantially reduced in groups fed only one time per day

75-000016 CONTINUED
and were not enhanced by feeding four times per day. The fact that food efficiencies were similar in fish fed one, two, and four times per day indicated that food intake and not utilization was the growth limiting factor. In a study with automatic feeders, fish fed 24 times per day had significantly poorer gains and food efficiencies than those fed four or eight times per day.

75-000017 Hauser, W. J. (Univ. Calif., Imperial Valley Field Stn., 1004 East Holton Rd., El Centro 92243) INFLUENCE OF DIET ON GROWTH OF JUVENILE /TILAPIA ZILLII/. Prog. Fish-Cult. 37 (1): 33-35. Jan. 1975. SFA 20(3).

Juvenile /Tilapia zillii/ being cultured for biological control of aquatic weeds in irrigation canals were experimentally fed different diets: trout pellets, catfish pellets, rabbit pellets, and lettuce. Growth, growth rate, coefficient of condition, and intestinal fat deposits were largely correlated with the amount of protein in the diet. There was some evidence that adult /T. zillii/ grew faster on a pure lettuce diet than juveniles.

75-000018 Horak, D. (Colo. Div. Wildl., Ft. Collins 80521) NUTRITIONAL FISH DISEASES AND SYMPTOMS. Colo. Div. Wildl., Fish. Inf. Leafl. No. 29. 5p. Aug. 1975. SFA 20(3).

Nutritional fish diseases can be attributed to deficiency, excess, or improper balance of components present in the consumer food. Symptoms of these diseases have been spottily and incompletely reported in scores of publications. Halver (1972) presents the most complete collection of information on nutritional fish diseases in the book /Fish Nutrition/, but the organization necessitates that the entire 713 pages be reviewed for a still incomplete accounting. Contrarily, the /Nutrient Requirements of Trout, Salmon and Catfish/ is too brief a synopsis to diagnose diseases (National Research Council Subcommittee on Fish Nutrition, 1973).

This Leaflet is designed to contain reported information on nutritional fish diseases, mostly of trout, salmon, and channel catfish, and serve as a diagnostic guide. All symptoms observed on any fish are lumped together and thus some disorders discussed may not apply to any single fish species.

75-000019 Ketola, H. G. (U.S. FWS, Tunison Lab. Fish Nutr., Cortland, NY 13045) MINERAL SUPPLEMENTATION OF DIETS CONTAINING SOYBEAN MEAL AS A SOURCE OF PROTEIN FOR RAINBOW TROUT. Prog. Fish-Cult. 37 (2): 73-75. Apr. 1975. SFA 20(3).

The nutritional value of ash and dicalcium phosphate suppliments to a basal diet containing protein solely in the form of conventional soybean meal was determined in a 5-wk experiment with young-of-the-year rainbow trout (/Salmo gairdneri/). The ash, which was prepared from fish protein concentrate, contained high levels of calcium and phosphorus. Suppliments of either ash or dicalcium phosphate significantly improved growth, feed conversion, and mineralization of bone.

75-000020 Leary, D. F.; Lovell, R. T. (USAID/Philippines, APO San Francisco, CA 96528) VALUE OF FIBER IN PRODUCTION-TYPE DIETS FOR CHANNEL CATFISH. Trans. Am. Fish. Soc. 104 (2): 328-332. Apr. 1975. SFA 20(3).

The effect of dietary fiber level on growth and carcass composition of channel catfish and on pond water quality was studied by feeding fingerlings (30 per 20 m pond) practical type feeds that contained identical nutrient components but graded levels of fiber ranging from 2 to 20 percent. After 200 days, fish fed the 2 percent fiber feed had gained 3,132 kg/hectare; this was significantly (P less than 0.05) more than fish fed the 14 percent fiber feed (2,468 kg/hectare) or 20 percent fiber feed (2,532 kg/hectare), but not the 8 percent fiber feed (2,705 kg/hectare). Fiber level had no significant effect on composition or dress-out percentage of the carcasses. In the last 30 to 60 days, the ponds receiving the higher fiber-diets showed lower dissolved oxygen than the cthers. Although previous work has indicated that added cellulose is beneficial in purified fish diets, results from this study suggest that fiber provides no nutritional benefit in production-type feeds for channel catfish and when fed in large amounts may lower water quality.

75-000021 Meyers, S. P.; Brand, C. W. (Dep. Food Sci., La. State Univ., Baton Rouge 70803) EXPERIMENTAL FLAKE DIETS FOR FISH AND CRUSTACEA. Prog. Fish-Cult. 37 (2): 67-72. Apr. 1975. SFA 20(3).

Drum drying techniques and principles of flake processing have been applied to development of fabricated water-stable diets for feeding of aquatic animals. Considerations of processing variables on the final composition of the flake product are discussed in terms of the diversity of applications in aquatic animal nutrition. A range of possible formulations are noted along with data on proximate analysis and ingredient characteristics. Such diets have been shown to be effective in supporting growth of a range of tropical fishes as well as serving as a supplement to brine shrimp in culture of larval penaeids and the freshwater prawn /Macrobrachium rosenbergii/.

75-000022 Murai, T.; Andrews, J. W. (P.O. Box 13687, Savannah, GA 31406) PANTOTHENIC ACID SUPPLEMENTATION OF DIETS FOR CATFISH FRY. Trans. Am. Fish. Soc. 104 (2): 313-316. Apr. 1975. SFA 20(3).

Two studies were conducted with channel catfish fry (/Ictalurus punctatus/) fed diets containing four levels of pantothenic acid activity (10, 25, 66, and 250 mg/kg diet). Supplemental pantothenate markedly improved growth rate, survival, and feed conversion, and prevented a loss of appetite, clubbed gills, and sluggishness. The results of these experiments suggest that diets fed to catfish fry should contain at least 250 mg of pantothenic acid per kg of diet.

75-000023 Reece, D. L.; Wesley, D. E.; Jackson, G. A.; Dupree, H. K. (Dep. Wildl. Fish., Miss. State Univ., Mississippi State 39762) A BLOOD MEAL-RUMEN CONTENTS BLEND AS A PARTIAL OR COMPLETE SUBSTITUTE FOR FISH MEAL IN CHANNEL CATFISH DIETS. Prog. Fish-Cult. 37 (1): 15-19. Jan. 1975. SFA 20(3).

Three diets were fed to channel catfish (/Ictalurus punctatus/) to test the value of a dried blood meal and rumen contents mixture as a possible protein substitute for fish meal. The control diet utilized fish meal as its primary animal protein component. One experimental diet used a blend of 60 percent blood meal and 40 percent rumen contents to completely replace the fish meal portion of the total diet. The other experimental diet utilized the same mixture of the blood meal-rumen contents blend, but only 1/2 of the fish meal was replaced. Field tests were conducted on one-tenth-acre ponds for 18 wk

75-000023 CONTINUED
and laboratory tests were conducted in flow-through aquariums for 17 wk. No statistically significant differences (P less than .05) were noted between fish growth and survival when the fish were fed different diets in ponds or aquariums. Feed conversion efficiency was good in the field study but relatively poor in the laboratory investigation. Test results indicate that a blood meal-rumen contents blend has value as a partial or complete substitute for fish meal in commercial catfish rations and that further investigation of its utilization is warrented.

75-000024 Satia, B. P.; Brannon, E. L. (Coll. Fish., Univ. Wash., Seattle 98195) THE VALUE OF CERTAIN FISH-PROCESSING WASTES AND DOGFISH (/SQUALUS SUCKLEYI/) AS FOOD FOR COHO SALMON (/ONCORHYNCHUS KISUTCH/) FRY. Prog. Fish-Cult. 37 (2): 76-80. Apr. 1975. SFA 20(3).

Feeding studies with coho salmon (/Oncorhynchus kisutch/) fingerlings revealed that certain by-products of the fish processing industry are good food sources. Herring (/Clupea harengus pallasi/), cod (/Gadus macrocephalus/), and flatfish (Pleuronectidae) fillet wastes arpoor results.

75-000025 Tarrant, R. M., Jr.; Dunnahoe, J. E. (U.S. FWS, Fish Farming Develop. Cent., Rohwer, AR 71666) AN ADJUSTABLE AUTOMATIC FEEDER. Prog. Fish-Cult. 37 (2): 108-111. Apr. 1975. SFA 20(3).
An adjustable fish feeder operated by AC solenoids and an electric timer automatically dispenses at selected intervals 31 to 3,664 g of floating food pellets (4.1-m-diameter) or 48 to 5,342 g of sinking food pellets (4.8-m-diameter) per feeding with an error of less than 2 percent.

75-000026 Viola, S. (Miloubar Ltd., D. N. Asherat, Israel) EXPERIMENTS ON NUTRITION OF CARP GROWING IN CAGES PART 2: PARTIAL SUBSTITUTION OF FISH MEAL. Bamidgeh 27 (2): 40-48. June 1975. SFA 20(3).
Nutrition experiments with carp were carried out in a series of wire cages, each containing 100-200 fish of 300-400 grams within 1m of water. The control ration contained 15 percent fishmeal and 25 percent total crude protein in 4 mm pellets. Two-thirds of the fishmeal was replaced by soya bean meal and balanced by the addition of amino acids, oil, minerals and vitamins in a test rating which gave a severely decreased growth rate. Since fish oil was inefficient in stimulating the growth rate with the test ration, the "fish factor" appears to be associated with the protein fraction of the meal. When the fish meal was partially replaced by animal protein meals, a growth rate comparable to the control was obtained.

TRANSPORTING FISH

75-000027 Marathe, V. B.; Huilgol, N. V.; Patil, S. G. (Dep. Zool., Inst. Sci. Nagpur, India) HYDROGEN PEROXIDE AS A SOURCE OF OXYGEN SUPPLY IN THE TRANSPORT OF FISH FRY. Prog. Fish-Cult. 37 (2): 117. Apr. 1975. SFA 20(3).
To determine whether hydrogen peroxide can be used as a substitute for oxygen gas in the transport of fish fry, experiments were conducted in closed 1-liter bottles for a period of 72 h. It was estimated that one drop (1 ml = 20 drops) of 6 percent hydrogen peroxide yields approximately 1.5 ppm of oxygen when added to 1 liter

75-000027 CONTINUED
of water. In a closed bottle containing 1 liter of water, 50 /Cyprinus carpio/ fry of 1.5- to 2.0-cm length were kept for a period of 72 h. Two drops of hydrogen peroxide were added to the water at 4-h intervals during the daytime only; 18 drops were used in all. At the end of the experiment, 43 fry (86 percent) survived; the nighttime mortality of seven fry was probably caused by depletion of dissolved oxygen. In another experiment with 25 fry, 12 drops of hydrogen peroxide were used and the survival was 100 percent. In the control experiment in which no hydrogen peroxide was used, all the fry died. The physico-chemical conditions of the water have been estimated. The proper dosage of hydrogen peroxide should be predetermined; the dissolved oxygen value should not exceed the normal requirement of the fry.

75-000028 Mires, D.; Shak Y.; Shilo, S. (Kibbutz ein Hamifratz, Israel) FURTHER OBSERVATIONS ON THE EFFECT OF SALINITY AND TEMPERATURE CHANGES ON /MUGIL CAPITO/ AND /MUGIL CEPHALUS/ FRY. Bamidgeh 26 (4): 104-109. Dec. 1974. SFA 20(3).

Young mullet fry, caught in the littoral and river estuaries and transferred to fish ponds, are subject to extreme changes of temperature and salinities, and suffer heavy mortality. Tests were carried out to evaluate the significance of these factors and their influence on the high percentage of mortality.

/M. cephalus/ and /M. capito/ fry were subjected to sudden changes of salinity and temperatures. /M. cephalus/ suffered high mortality when transferred from 24,600 mgCl/l to 822 mgCl/l. Survival was higher when they were transferred gradually through a range of salinities from 2,640 mgCl/l to 90 mgCl/l.

/M. cephalus/ suffered heavier losses when transferred from 6,900 mgCl/l at lower temperatures, (10 C) than at higher temperatures (17 C).

/M. capito/, previously adapted to freshwater, survived when transferred from sea water to freshwater and vice versa at various temperatures. /M. capito/, recently caught, did not survive sudden changes of temperature and salinity.

MISCELLANEOUS CULTURE TECHNIQUES AND EQUIPMENT

75-000029 Aulstad, D.; Refstie, T. (Inst. Anim. Genet. Breed., Agric. Univ. Norway, AS-NLH, Norway) THE EFFECT OF WATER DEPTH IN REARING TANKS ON GROWTH AND MORTALITY OF SALMON AND RAINBOW TROUT FINGERLINGS. Prog. Fish-Cult. 37 (2): 113-114. Apr. 1975. SFA 20(3).

There were no significant differences in growth or mortality of /Salmo gairdneri/ raised in tanks with water depths of 10, 18, and 26 cm. (RS)

75-000030 Guerrero, R. D. III (Agric. Exp. Sta., Auburn, AL 36830) USE OF ANDROGENS FOR THE PRODUCTION OF ALL-MALE /TILAPIA AUREA/ (STEINDACHNER). Trans. Am. Fish. Soc. 104 (2): 342-348. Apr. 1975. SFA 20(3).

An all-male population of /Tilapia aurea/ was produced with 17 alpha-ethynyltestosterone at 60 ug/g diet. Heterogamety of /T. aurea/ females was determined. A relationship between the percentage of males and the total weight of fish indicated the faster growth of androgen-treated fish. The feeding of 1-dehydrotestosterone acetate, 17 alpha-ethynyltestosterone and 17 alpha-methyltestosterone at various dosage levels for 18 days to sexually undifferentiated /T. aurea/ fry in

75-000030 CONTINUED
tanks neither affected survival nor altered growth of fry. No difference was observed in survival between androgen-treated and untreated fish in plastic pools for 120 days. Some andrcgen-treated groups were significantly heavier than the control. Treatment with ethynyltesterone and methyltestosterone at all dosage levels resulted in significantly higher percentages of males than the control. Degeneration of testes was observed with treatment of methyltestosterone at 60 ug/g diet. No ovotestis condition was found. Sex ratios of the progenies of three ethynyltestosterone-treated and six methyltestosterone-treated males individually bred with untreated females ranged from 2 to 3.1 females:1 male. These were significantly different from the expected 1:1 ratio of sexes and indicated that sex reversal of genetic females had been achieved. Sex reversal appears to be a practical method for producing monosex male tilapia.

75-000031 Hunter, C. J.; Joyner, T. (NMFS, 2725 Montlake Blvd. E., Seattle, WA 98112) A SELF-CLEANING FLOATING FISH TANK. Prog. Fish-Cult. 37 (2): 115-116. Apr. 1975. SFA 20(3).

Still waters of lakes and ponds represent an untapped resource for intensive fish culture. Increased demand for salmon culture brought about by declining runs, pen culture, and ocean ranching will require increased production capability. An economical method to move and aerate these still waters would help increase production and may bring a new dimension to the efficiency and cost of fish culture. Such a method employs the airlift principal to supply and flush the water from a floating tank. Water is lifted into the tank by a stream of air bubbles and circulates in a helical motion through the bottom, sweeping out uneaten food and feces.

75-000032 Peterson, E. J. (U.S. FWS, Lamar Fish Cult. Develop. Cent., Lamar, PA 16848) A COMPOSITE WATER SAMPLER FOR HATCHERY EFFLUENT STUDIES. Prog. Fish-Cult. 37 (1): 59-61. Jan. 1975. SFA 20(3).

A composite water sampler for fish hatchery effluent studies was developed at the Lamar Fish Cultural Development Center. It was designed to deliver 100-ml samples into a 2 1/2 gallon cubitainer on a programmable basis, from a high velocity flow, while subjecting suspended solids to minimal physical alteration. The system operates of 110 volts, 60Hz, drawing a maximum of 65 W during each 15 s pumping cycle. The sample is extracted in a sample chamber before passing through a self priming centrifugal pump. Component costs fcr the first unit is $145 and subsequent units are $98 each.

GENERAL LIMNOLOGY AND OCEANOGRAPHY

75-000033 Cook, S. K. (Atl. Environ. Group, NMFS, RR 7A, Box 522-A, Narragansett, RI 02882) EXPENDABLE BATHYTHERMOGRAPH OBSERVATIONS FROM THE NMFS/MARAD SHIP OF OPPORTUNITY PROGRAM FOR 1972. NOAA Tech. Rep. NMFS SSRF-692. iv + 81p. June 1975. SFA 20(3).

Results of the second year of operation of the NMFS/MARAD Ship of Opportunity Program are presented in the form of vertical distributions of temperature and horizontal distributicns of sea surface salinity and temperature. Operational and data management procedures also are discussed.

75-000034 Lorenz, B. D. (Dep. Biol., W.Va. Univ., Morgantown 26506) WATER QUALITY, NUTRIENTS, AND NET PLANKTON ANALYSIS OF SUMMERSVILLE LAKE. Proc. W.Va. Acad. Sci. 45 (2): 146-154. 1973. SFA 20(3).

Analysis of chemical parameters and the net plankton community in Summersville Lake, West Virginia, were conducted during a year long limnological investigation. Primarily a flood control basin, the reservoir is subjected to extreme annual fluctuations in water level. Sampling was conducted on a semimonthly basis at a point near the dam. Samples for chemical analysis were taken at each five meter interval while those used for net plankton analysis were taken at each of the first fifteen meters and again at twenty meters. Two twenty meter vertical tows were taken on each date using a No. 25 Wisconsin net. These tows were used in the determination of net plankton volumes.

Chemical analysis involved the determination of nitrate and molybdate reactive orthophosphate. Net plankton samples were counted and identified to the species level.

The mean concentration of nitrate in the top twenty meters during the stratification period was 2.1 mg/l. The mean concentration of molybdate reactive orthophosphate in the top twenty meters during the same period was 8.5 ug/l. The net plankton community consisted primarily of copepods, cladocerans, rotifers, and non-filamentous green algae with copepods constituting the major portion. Seasonal alternation was apparent between the cyclopoid copepods /Cyclops bicuspidatus thomasi/ and /Mesocyclops edax/, the latter becoming common during early summer. Seasonal succession of four species of /Daphnia/ was also observed during the investigation. Flood conditions resulting from Hurricane Agnes exerted an obvious effect on all biological and chemical parameters investigated.

On the basis of nutrient concentrations and species composition, Summersville Lake appears to be mesotrophic.

75-000035 Yahnke, J. W. (Dep. Biol., W.Va. Univ., Morgantown 26506) CHLOROPHYLL CONCENTRATIONS, WATER QUALITY, AND NUTRIENT CONCENTRATIONS IN CHEAT LAKE, WEST VIRGINIA. Proc. W.Va. Acad. Sci. 45 (2): 155-163. 1973. SFA 20(3).

A study of the chemical environment of Cheat Lake, West Virginia, and two of its less acid backwaters was conducted from May through October of 1972. Based on the chemical environment, the lake and its two backwaters were shown to constitute three distinct systems, with Morgan Run being intermediate between the lake and Ruble's Run. The chemical environment was found to be much more variable in the backwaters than in the lake. Variation was due to incursions of lakewater into the backwaters, which were more frequent and more intense in Morgan Run than in Ruble's Run, due to the morphometry of the lake in that area. Chlorophyll concentrations were much greater in the lake than in either of the backwaters; the chlorophyll concentrations in the backwaters were similar. Chlorophyll concentrations were greater in the lake due to the greater stability of the chemical environment in the lake. The concentrations of chlorophyll and dissolved phosphate showed marked seasonality falling to their lowest levels following the onset of thermal stratification.

PHYSICAL LIMNOLOGY AND OCEANOGRAPHY

75-000036 Ingham, M. C. (Atl. Environ. Group, NMFS, Narragansett, RI 02882) VELOCITY AND TRANSPORT OF THE ANTILLES CURRENT NORTHEAST OF THE BAHAMA ISLANDS. NOAA Fish. Bull. 73 (3):P626-632. July 1975. SFA 20(3).

Meridional geostrophic velocities and volume transports were computed from data collected on six occupations of Standard Section A-7 by U.S. Coast Guard cutters. The section extends offshore from Cape Canaveral, Fla., along lat. 28 degrees 35 min. N for about 520 nautical miles (960 km), but this study involved only that portion seaward of the 800-m isobath (situated at about long. 79 degrees 30 min. W), a portion which would transect the Antilles Current just before it merges with the Gulf Stream. The velocity sections did not reveal a broad northward flowing Antilles Current in the surface layer as has been shown on many average current charts in the past. Instead, the sections revealed a generally sluggish (less than or equal to 10 cm/s) surface flow, either northward or southward. Imbedded in the low speed surface flow were two bands of higher speed (10-40 cm/s), one northward and the other southward, usually located in the vicinity of the 1,000-fathom (1,830-m) isobath. Computed net transport for the sections ranged from 30.4 X 10 m s northward to 6.4 X 10 m s southward, with an average of 8.6 X 10 m s northward, which is considerably less than customarily hypothesized in the past to provide for the observed downstream increase in Gulf Stream transport between the Straits of Florida and Cape Hatteras, N. C.

The position of the band of relatively rapid southward flow corresponded approximately with the position suggested by Kort for the southward flowing Antilles-Guiana Countercurrent. A comparison of temperature-salinity properties in the bands showed them to be identical with each other but different from Florida Current water, making it highly unlikely that the bands are manifestations of two continuous currents, the Antilles Current and Antilles-Guiana Countercurrent, from different source areas. The identical temperature-salinity properties of the bands indicate that they are manifestations of eddies or a countercurrent formed by recurving of an adjacent current; the former alternative appears more likely.

The importance of the Antilles Current as a means of transporting significant quantities of pelagic ichthyoplankton into the Gulf Stream system is doubtful. The current speeds and transports appear to be substantially less than hypothesized and highly variable. An alternate means of transport of ichthyoplankton in the surface layer which may be in operation is Ekman drift generated by local winds, yielding a flow which may not be reflected in the field of mass and geostrophic computations.

75-000037 Sunde, L. A.; Barica, J. (Inquiries to: Res. Dev. Dir., Freshwater Inst., Winnipeg, MB, Can) GEOGRAPHY AND LAKE MORPHOMETRY OF THE AQUACULTURE STUDY AREA IN THE ERICKSON-ELPHINSTONE DISTRICT OF SOUTHWESTERN MANITOBA. Environ. Can., Fish. Mar. Serv., Res. Dev. Dir., Tech. Rep. no. 510. v + 35p. 1975. In English with French summ. SFA 20(3).

The aquaculture study area is located in central Canada at about 50 degrees 30 min N - 100 degrees 10 min W at an altitude of 500 - 650 m. The whole area (800 km is an undulating glacial till plain underlain by cretaceous shales of the Riding Mountain Formation. Soils are 70 percent grey-black and 20 percent grey-wooded. Mean annual temperature is 1 C and frost-free days are 85 - 110. Annual precipitation is 450 - 480 mm, snowfall 1140 - 1270 mm, potential evapotranspiration 525 - 550 mm and mean moisture deficit about 100 mm. The main resource base of the area is grain and cattle farming. About 52 percent of the land

75-000037 CONTINUED
is under cultivation. Population density is about 3.5 people/km
Thousands of marshes, sloughs and pothole lakes occupy the depressions that lie between numerous knolls and ridges. Surface drainage is local because of the hummocky terrain and porous nature of the unconsolidated glacial drift. A very large proportion of the lakes are landlocked, with no surface inflow or outflow. They are highly eutrophic and productive and typically shallow and unstratified. Most lakes regularly winterkill so few contain native fishes.
Experiments were initiated in 1968 to test the utility of these lakes for the commercial production of rainbow trout. To date 71 lakes, 1 - 25 ha in area, have been experimentally stocked. Their area and depth frequency distribution is described and bathymetric charts of 16 lakes are presented.

75-000038 Webster, T. J. M.; Paranjape, M. A.; Mann, K. H. (Paranjape, M. A.: Dep. Environ., Bedford Inst. Oceanogr., Dartmouth, N. S. B2Y 4A2, Can.) SEDIMENTATION OF ORGANIC MATTER IN ST. MARGARET'S BAY, NOVA SCOTIA. J. Fish. Res. Board Can. 32 (8): 1399-1407, Aug. 1975. In English with French summ. SFA 20(3).
Sediment traps were placed at two sites in St. Margaret's Bay. At a deep station (70 m), traps were placed 5 m and 10 m above the bottom; at a shallow station (10 m), six traps were placed between 45 and 197 cm above the bottom. Total catch averaged 118 g C $m^{-2}yr^{-1}$ at the deep station and 134 g C $m^{-2}yr^{-1}$ at the shallow station. The most probable source of the organic matter was detritus derived from seaweeds and seagrasses, but the most probable source of inorganic material was bottom sediment. It is suggested that the traps were taking bottom sediment resuspended from shallow water, enriched by detritus from seaweeds and seagrasses.

BENTHOS

75-000039 Becker, C. D.; Genoway, R. G.; Merrill, J. A. (Battelle Memorial Inst., Pac. NW Lab., Richland, WA 99352) RESISTANCE OF A NORTHWESTERN CRAYFISH, /PACIFASTACUS LENIUSCULUS/ (DANA), TO ELEVATED TEMPERATURES. Trans. Am. Fish. Soc. 104 (2): 374-387. Apr. 1975. SFA 20(3).
/Pacifastacus leniusculus/ from two populations in Washington State, the central Columbia River and a small tributary, were acclimated at 5 C intervals and exposed to elevated temperatures in 48 hour thermal bioassays. The upper lethal temperature for both crayfish populations increased relatively slightly, from about 28.5 to 31.5 C, over the entire acclimation range. A rise of 1 C in test temperature often represented the difference between zero and total mortality when lethal limits were approached. The ultimate upper lethal temperature was near 32-33 C. Statistically significant differences in thermal resistance patterns (slope and spacing of regression lines) occurred between the two crayfish populations at all acclimation levels, but resistance in terms of eventual mortality was similar for practical purposes. Moulting individuals were particularly susceptible to high temperature stress. Mature, pre-breeding female crayfish from the Columbia River during fall appeared less resistant, and egg-bearing females during winter more resistant, than other individuals. Larger crayfish from the Columbia River were slightly less resistant to elevated temperatures than smaller ones, and females were more resistant than males. The upper temperature triangle for /P. leniusculus/ encompasses an area of 424 C^2. This freshwater decapod is more tolerant of elevated temperatures than native salmonids, but less tolerant than some introduced "warmwater" fish.

75-000040 Clady, M. (Dep. Nat. Resour., Cornell Univ., Ithaca, NY) COMPARISON OF THE BOTTOM FAUNA IN 1916 AND 1967 IN A BAY OF ONEIDA LAKE, NEW YORK. N.Y. Fish Game J. 22 (2): 115-121. July 1975. SFA 20(3).

Quantitative studies of the benthic invertebrates of Lower South Bay (Oneida Lake) had been made in 1916 and were repeated in 1967. The number and frequency of occurrence of Tubificidae and Amphipoda were higher in 1967, while Ephemeroptera and Trichoptera had decreased significantly.

75-000041 Gale, W. F.; Thompson, J. D. (Ichthyol. Assoc., Inc. R.D. 1, Berwick, PA 18603) A SUCTION SAMPLER FOR QUANTITATIVELY SAMPLING BENTHOS ON ROCKY SUBSTRATES IN RIVERS. Trans. Am. Fish. Soc. 104 (2) : 398-405. Apr. 1975. SFA 20(3).

The dome (suction) sampler is a self-contained unit that consists of five main parts: (i) a transparent acrylic hemisphere to enclose an area of the river bottom; (ii) a bilge pump to vacuum organisms out of the sampler; (iii) a net to collect organisms as they are pumped out; (iv) a bag for collecting large stones; and (v) a band to seal the space between the dome and the substrate.

The dome sampler was designed to be used by a SCUBA diver to sample benthos quantitatively on 0.18 m of cobble-gravel substrate in the North Branch of the Susquehanna River. The sampler was used throughout the year, often under such adverse conditions as strong currents, cold water, and poor visibility. The sampler can be used in water 0.4-1.0 m deep without SCUBA.

Eighty-two percent of the organisms released inside the sampler were recovered during efficienty tests. Most organisms collected with the sampler were in identifiable condition. Ten minutes pumping per sample was required for best results. The sampler was more efficient than the Peterson, Ekman, and Ponar grabs, a corer, and the Surber sample in collecting benthic microinvertebrates from substrates in our study.

Twenty-two familes of benthic invertebrates were collected in dome and artificial substrate (Bar-B-Q basket) samples. Only 12 families occured in both and there were major differences in the relative abundance of some of them. Population trends formulated with data from the two samplers did not agree.

75-000042 Goddard, C. I.; Goodwin, M. H.; Greig, L. A. (Dep. Biol., York Univ., Downsview, Ont. M3J 1P3, Can.) THE USE OF ARTIFICIAL SUBSTRATES IN SAMPLING ESTUARINE BENTHOS. Trans. Am. Fish. Soc. 104 (1): 50-52. Jan. 1975. SFA 20(3).

A comparison was made between density estimates of estuarine benthos based on artifical substrate sampling and direct observation by divers. Differences suggest that artificial substrates may preferentially sample certain portions of the fauna, leading to erroneous estimates of population size.

75-000043 Karl, D. M.; LaRock, P. A. (Dep. Oceanogr., Fla. State Univ., Tallahassee 32306) ADENOSINE TRIPHOSPHATE MEASUREMENTS IN SOIL AND MARINE SEDIMENTS. J. Fish. Res. Board Can. 32 (5): 599-607. May 1975. In English with French summ. SFA 20(3).

A sulfuric acid-EDTA method for extracting ATP from soil and marine sediments was devised. The efficacy of this method is compared to the boiling Tris extraction prccedure. Efficiency of ATP recovery from solid substrates typically ranged between 81-94 percent for the sulfuric acid-EDTA procedure in comparison to a recovery of 3-6 percent using boiling Tris buffer. The presence of various ions in the acid extract, however, inhibited light emission in the luciferin-

75-000043 CONTINUED
luciferase measurement of ATP. Addition of EDTA to the extract reduced but did not eliminate the ionic interference. An internal ATP standard was thus used to determine the magnitude of the residual interference.

75-000044 Ledoyer, M. (Sta. Mar. d'Endoume, Marseille, Que. Can.) LES PEUPLEMENTS BENTHIQUES CIRCALITTORAUX DE LA BAIE DES CHALEURS (GOLFE DU SAINTE-LAURENT). [THE NEAR-LITTORAL BENTHIC POPULATIONS OF CHARLEUR BAY (GULF OF ST. LAWRENCE).] Trav. Pech. Que. No. 42. 141p. June 1975. In French with English summ. SFA 20(3).

Study of distribution of benthic invertebrates in relation with the silt content of sediments allows to separate groups of species needing approximately the same living conditions. Three groups are clearly identified.

1) one of non mixed clays.
2) one of sands.
3) one including muddy species widely distributed in clays, sandy clays and silty sands.

A fourth group is composed by species showing a more confused distribution in the sandy clays and silty sands so that they are absent in silty or sandy areas.

Study of distribution of benthic invertebrates in relation with bathymetry shows three stages of replacement of numerous species by others. Mapping of distribution of the most frequent species in a more finely prospected area, points out these three faunal assemblages in soft bottoms. In the same time fauna of heterogeneous bottoms is defined.

From these facts an attempt is made to define the characteristics of these three faunal assemblages. They appear induced by the nature of water masses and in other hand by grain -- size of bottom sediments. The first biocoenosis is developed just under boreal waters and in sandy bottoms; it is called "Sands under boreal waters biocoenosis". The two other ones are developed under arctic waters and need special granulometric conditions: one inhabits the silty sands (10 - 50 percent silt). It is called "Silty sands under arctic waters biocoenosis" in opposition to the other one which colonized sandy clays and pure clays (50 to more than 80 percent silt) called "Clays under arctic waters biocoenosis".

Study of the fauna inhabiting inner parts of the Chaleurs Bay is not included in this work: the important silt content of the upper levels in these areas induced complex distributions that will be analysed in a forthcoming paper. Finally, the author draws attention upon the two concepts of "community" and "biocoenosis" and tries to compare the described arctic communities and the biocoenosis encounted in the Chaleur Bay (Gulf of St. Lawrence).

75-000045 Stern, D. H.; Stern, M. S. (Dep. Biol., Univ. Mo., Kansas City 64110) AN IMPROVED INEXPENSIVE PERIPHYTON SAMPLER. Prog. Fish-Cult. 37 (1): 55-56. Jan. 1975. SFA 20(3).

An improved durable version of a simple, inexpensive wooden periphyton sampler was constructed for use under harsh conditions during a two-flood year in the lower Missouri River. Explicit instructions for building the sampler are provided, as are suggestions for on-site rigging using thin-wall conduit or steel aircraft cable.

75-000046 Swanson, G. A.; Thornsberry, W. H. (U.S. FWS, Jamestown, ND 58401) A CIRCULAR CHAMBER FOR COUNTING BENTHIC INVERTEBRATES. Trans. Am. Fish. Soc. 104 (2): 406-407. Apr. 1975. SFA 20(3).

A large circular counting chamber was designed to facilitate the enumeration of benthic invertebrates under magnification.

PLANKTON

75-000047 Damkaer, D. M. (Pac. Mar. Environ. Lab., NCAA, Univ. Wash. WB-10, Seattle, WA 98195) CALANOID COPEPODS OF THE GENERA /SPINOCALANUS/ AND /MIMOCALANUS/ FROM THE CENTRAL ARCTIC OCEAN, WITH A REVIEW OF THE SPINOCALANIDAE. NOAA Tech. Rep. NMFS CIRC-391. x + 88p. June 1975. SFA 20(3).

The family Spinocalanidae includes small to medium-sized marine calanoid copepods belonging to the genera /Spinocalanus/, /Monacilla/, /Mimocalanus/, and /Teneriforma/. All species are deep-living and often comprise a large proportion, or even a majority, of the copepods in deep samples. In spite of their prevalence, definitive knowledge of the Spinocalanidae has lagged behind that of other copepod groups because adequate collections from deep water have been few, and specimens from widely separated localities have seldom been compared. Most important, however, is the fact that the fragility of the specimens makes them very difficult to study; most investigators attempting to describe or identify Spinocalanidae have indicated that their specimens were damaged and incomplete.

The present study is based on collections of zooplankton from Fletcher's Ice Island, T-3, in the Canadian Basin of the Arctic Ocean in 1967-68. The seven species of Spinocalanidae from these collections are redescribed, and their vertical distributions are discussed, based on series of samples from discrete depth intervals to 3,000 m.

The systematics of the Spinocalanidae has been reconsidered, using characters in addition to those most commonly lost in sampling. All published descriptions and records are discussed. Several critical type specimens and specimens forming the bases of widespread records have been examined and are redescribed. Keys to the genera and all of the species have been prepared, with the goals of enabling an investigator to identify even damaged specimens. Many named species or forms have been placed in synonymy, and two new species (/Spinocalanus terranovae/ and /Mimocalanus heronae/) are described. The family is now considered to comprise 32 species, distributed as follows: /Spinocalanus/ (19), /Monacilla/ (4), /Mimocalanus/ (8), and /Teneriforma/ (1).

75-000048 DeGraeve, G. M.; Reynolds, J. B. (Dep. Biol. Sci., Grand Valley State Coll., Allendale, MI 40401) FEEDING BEHAVIOR AND TEMPERATURE AND LIGHT TOLERANCE OF /MYSIS RELICTA/ IN THE LABORATORY. Trans. Am. Fish. Soc. 104 (2): 394-397. Apr. 1975. SFA 20(3).

Live specimens of /Mysis relicta/ from Lake Michigan were held for one year in the laboratory to determine feeding behavior and tolerance to light and temperature. Mysids fed by moving with rapid, horizontal jerking movements toward food as it settled toward the bottom and by swimming slowly, upside down, to gather particles floating on the surface. Scavenging was common. Mysids tolerated considerably higher temperatures than previously reported. Temperature increases (from 5 C) of 1 C per day and 1 C per minute resulted in TL(m) values of 20.5 C and 20.4 C, respectively. Mortality increased rapidly at temperatures above 13 C. The upper lethal limit for mysids acclimated to 5 C was about 22 C. Survival under continuous, high light intensity (32 foot-candles) was considerably higher than previously reported.

75-000048 CONTINUED
Low water temperature (5 C) may have increased light tolerance.

75-000049 Kling, H. (Freshwater Inst., Winnipeg, MB, Can.) PHYTOPLANKTON SUCCESSIONS AND SPECIES DISTRIBUTION IN PRAIRIE PONDS ON THE ERICKSON-ELPHINSTONE DISTRICT, SOUTHWESTERN MANITOBA. Environ. Can., Fish. Mar. Serv., Res. Dev. Dir., Tech. Rep. No. 512. i + 31p. 1975. In English with French summ. SFA 20(3).
The phytoplankton of approximately 50 small prarie lakes in the Erickson-Elphinstone district of Southwestern Manitoba have been surveyed since 1972. During 1973 seasonal succession studies were conducted on 5 of the lakes (Nos. 885, 154, 882, 255, 103). These are described in detail in this report. The species list for the area includes species from a total of 46 lakes which were sampled during the years 1972-1974.

75-000050 Kost, A. L. B.; Knight, A. W. (9321 Discovery Way, Apt. H, La Jolla, CA 92037) THE FOOD OF /NEOMYSIS MERCEDIS/ HOLMES IN THE SACRAMENTO-SAN JOAQUIN ESTUARY. Calif. Fish Game 61 (1): 35-46. Jan. 1975. SFA 20(3).
Gut contents were determined in approximately 1500 opossum shrimp, /Neomysis mercedis/ Holmes, from the Sacramento-San Joaquin Estuary. The shrimp, obtained from 12 stations over a 13-month period, were 2 to 17 mm (0.08 to 0.67 inch) long.
The most abundant items in the gut were detritus and diatoms. The percentage of detritus relative to diatoms was greater in winter than in summer, and increased with shrimp size.
Forty kinds of diatoms were found in the gut. Certain diatom genera predominated in shrimp from particular locations and in shrimp collected during particular times of the year.
Animal fragments and other items also encountered were much less abundant than detritus and diatoms.
Thus, the shrimp appears to eat a variety of food items.

75-000051 Peterson, W. T.; Miller, C. B. (Miller, C. B.: Sch. Oceanogr., Oregon State Univ., Corvallis 97331) YEAR-TO-DATE VARIATIONS IN THE PLANKTOLOGY OF THE OREGON UPWELLING ZONE. NOAA Fish. Bull. 73 (3): 642-653. July 1975. SFA 20(3).
Sampling results from Oregon coastal waters show that plankton abundance in 1971, a year of reduced coastal upwelling, was lower than in 1969 or 1970. This was correlated with greater frequency and abundance in 1971 for species usually found more offshore and with a general reduction in the number and density of the most strictly neritic species. It is proposed that these changes are related to changes in nearshore fisheries which, therefore, appear to depend upon the general stimulation of production by upwelling.

75-000052 Poulet, S. A.; Chanut, J. P. (Inst. Nat. Rech. Sci., IRNS --Oceanologie, Univ. Que., Rimouski, Que., Can.) NONSELECTIVE FEEDING OF /PSEUDOCALANUS MINUTUS/. J. Fish. Res. Board Can. 32 (5): 706-713. May 1975. In English and French summ. SFA 20(3).
Feeding by adult females of /Pseudocalanus minutus/ on naturally occurring particles was determined by comparing particle size spectra in the water and that removed from it as the ration. Mean diameters and variances computed for the overall particle spectra were similar in both water and ration. Cumulative frequencies of particle numbers and volumes computed for both water and ration were not significantly different in two thirds of the experiments. In one third of the experiments significant values were found, mainly due to addition of particles in the small size ranges, as a result of feeding. The

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hypothesis of nonselectivity by /Pseudocalanus minutus/ was not rejected by the Kolmogorov-Smirnov's test. It is suggested that wh particle peaks occur copepods obtain a part of their ration from t most productive cells of the phytoplankton population.

75-000053 Reeve, M. R.; Baker, L. D. (Baker, L. D.: Rosenstiel Sc Mar. Atmos. Sci., Univ. Miami, Miami, FL 33149) PRODUCTION OF TWO PLANKTONIC CARNIVORES (CHAETOGNATH AND CTENOPHORE) IN SOUTH FLORIDA INSHORE WATERS. NOAA Fish. Bull. 73 (2) 238-248. Apr. 1975. SFA 20(3).

Seasonal changes in biomass and production of two planktonic carnivores, /Sagitta hispida/ Conant and /Mnemiopsis mccradyi/ Mayer were followed in a subtropical inshore marine environment. Productio was estimated as the product of mean daily biomass (calculated from the sampled biomass and computed mortality rates) and daily growth rate. The latter was determined from laboratory culture experiments a three temperatures. Seasonal fluctuations of ctenophore biomass and production were much greater than those of chaetognaths. Mean daily production in milligram carbon per square meter was 2.00 and 4.80 for /Sagitta/ in Card Sound and Biscayne Bay respectively, and 1.01 for /Mnemiopsis/in Biscayne Bay. The ctenophore was absent from Card Sound, possibly because the zooplankton standing crop was an order of magnitude lower than in Biscayne Bay (excluding ctenophores). Average production/biomass ratios were 0.31 for /Sagitta/ and 0.12 for /Mnemiopsis/.

75-000054 Selgeby, J. H. (U.S. FWS, Ashland, WI 54806) LIFE HISTORIES AND ABUNDANCE OF CRUSTACEAN ZOOPLANKTON IN THE OUTLET OF LAKE SUPERIOR, 1971-72. J. Fish. Res. Board Can. 32 (4): 461-470. Apr. 1975. In English with French summ. SFA 20(3).

In sampling throughout a year, at about 3-wk intervals, of the crustacean zooplankton discharged from Lake Superior through the St. Marys River, 30 species were collected, including three not previously recorded for the lake: the copepod /Cyclops strenuus/, and the cladocerans /Alona costata/ and /Alonella acutirostris/. Five copepods, /Cyclops bicuspidatus thomasi/, /Diaptomus ashlandi/, /D. sicilis/, /Limnocalanus macrurus/, and /Senecella calanoides/ were present in the plankton throughout the year while three other copepods, /Diaptomus minutus/, /Epischura lacustris/, and /Mesocyclops edax/, along with all cladocerans, were present only during summer and fall. Five species of copepods, /Diaptomus sicilis/, /D. minutus/, /Limnocalanus macrurus/, /Senecella calanoides/, and /Epischura lacustris/ produced a single generation annually; three other copepods and all cladocerans produced two of more generations. All species breed 1-3 mo later in Lake Superior than in lakes Michigan and Erie.

75-000055 Weiner, R. M.; Schimel, L.; Rosen, S. (Dep. Microbiol., Univ. Md., College Park 20742) THE ISOLATION OF /HYPHOMICROBIUM/ FROM THE MOUTH OF THE PATUXENT RIVER AND THE ISOLATION AND CHARACTERIZATION OF /HYPHOMICROBIUM/ FROM A ROCK CREEK TRIBUTARY. Chesapeake Sci. 16 (3): 153-161. Sept. 1975. SFA 20(3).

Bacteria belonging to the order Hyphomicrobiales comprised less than 0.01 percent of the planktonic bacterial community of water samples collected from the Chesapeake Bay and surrounding tributaries. These budding bacteria, however, were present in all of the 15 samples assayed. Two strains of Hyphomicrobia were isolated, one from the mouth of the Patuxent River and another from a Rock Creek tributary (/Hyphomicrobium/ RC).

/Hyphomicrobium RC was extensively characterized. Morphologically, talked cells ranged from 1.0 to 10.0 um in length and the stalks were

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0.2 to 0.3 um in diameter. Buds were 0.5 to 0.8 um in diameter. Cells characteristically produced monopolar stalks. Extensive branching and filament formation were not observed. Electron micrographs of thin-sectioned specimens failed to reveal the presence of a well-developed internal membrane system.

Of numerous carbon sources tested, /Hyphomicrobium/ RC grew only with methanol or methylamine. In both batch and continuous culture, the growth rate in the presence of methanol was about twice the rate in methylamine. Optimum growth conditions for /Hyphomicrobium/ RC were found to be pH 7.0, 30 C, and 0.5 percent NaCl. Under these conditions, colonies synthesized a yellow pigment on agar. The mole percent guanosine plus cytosine content of the deoxyribonucleic acid of /Hyphomicrobium/ RC was calculated to be 64.5 (that of other hyphomicrobia ranges from 59 to 67 percent). The strain had surface antigens which differed from those of 5 other representative isolates of /Hyphomicrobium/. These characteristics suggest that /Hyphomicrobium/ RC may be a previously undiscovered strain.

The ability of /Hyphomicrobium/ RC to degrade methanol, and of other strains to denitrify, may function to alleviate potential stress to aquatic ecosystems.

PRIMARY PRODUCTION

75-000056 Burkett, R. D.; Taylor, D. R. (Battelle Columbus Lab., 505 King Ave., Columbus, OH 43201) A BOTTLE HOLDER FOR /IN SITU/ PRIMARY PRODUCTIVITY STUDIES. Prog. Fish-Cult. 37 (2): 112. Apr. 1975. SFA 20(3).

A bottle holder is described that is easy to fabricate, inexpensive, and satisfactory for horizontal suspension of primary productivity incubation bottles.

75-000057 Fraser, J. E. (Dep. Biol., W.Va. Univ., Morgantown 26506) WATER QUALITY AND PHYTOPLANKTON PRODUCTIVITY OF SUMMERSVILLE RESERVOIR. Proc. W.Va. Acad. Sci. 46 (1): 8-16. 1974. SFA 20(3).

The phytoplankton productivity and various water quality parameters of Summersville Reservoir, West Virginia, were investigated biweekly from September 25, 1971 to October 7, 1972. Sampling was conducted at 3 stations with primary production being only determined at one of three sites. This seven-year old reservoir was thermally stratified in the summer months, having an epilimnion approximately 6 meters in depth. The lake has soft water with low values of alkalinity and conductivity and an absence of hot acidity.

No significant diffefences in t values were found between the three sites studied in the impoundment, with reference to water quality parameters. Carbon fixation ranged from 0.0 to 842.91 $mgC/m^3/day$. Areal production fluctuated from 3.48 $mgC/m^2/day$ to 3,176.16 $mgC/m^2/day$ and on a yearly basis it was 170.11 gC/m^2.

Total inorganic carbon was always found in sufficient concentrations, though a decrease was evident in the first few meters of the lake on days of high productivity. Light limitation caused by self-shading only occurred on the few dates of very high primary productivity, such as August 8, 1972.

Both Findernegg Type 1 and Type 3 vertical assimilation curves were found with Type 1 predominating. On the basis of production values, oxygen curves, transparency, and vertical assimilation curves, Summersville Lake was tentatively classified as mesotrophic.

75-000058 Richey, J. E.; Perkins, M. A.; Goldman, C. R., (Fish. Res. Inst., Univ. Wash., Seattle 98195) EFFECTS OF KOKANEE SALMON (/ONCORHYNCHUS NERKA/) DECOMPOSITION ON THE ECOLOGY OF A SUBALPINE STREAM. J. Fish. Res. Board Can. 32 (6): 817-821. June 1975. In English with French summ. SFA 20(3).

The role of kokanee salmon (/Oncorhynchus nerka/) carcass decomposition in the nutrient cycles and energy flow of a subalpine stream was investigated during a season (1970-71) of high spawner abundance and a season (1972-73) of low spawner abundance with a December storm flushing the stream of carcasses. Primary production, periphyton biomass, heterotrophic activity, and nutrient concentrations were greater downstream than upstream during the peak carcass decomposition of 1971, whereas they were the same at other times of that year and in 1972-73. Calculations showed that upstream-downstream differences in phosphate could be accounted for by the salmon carcasses.

75-000059 Schoumacher, R. (1404 Robertson St., Ft. Collins, CO 80521) WATER CHEMISTRY AND PHYTOPLANKTON PRODUCTION IN MONCOVE LAKE, MONROE COUNTY. Proc. W.Va. Acad. Sci. 46 (1): 39-44. 1974. SFA 20(3).

Physical and chemical parameters at Moncove Lake qualify it as a second-class dimictic lake. Carbon fixation ranged from 0-549 mg C/m^3/day with the maximum occurring on August 22. Areal production ranged from 11-1,070 mg C/m^2/day with the maximum value on June 13. Annual areal production was 99.76 g C/m^2. The clinograde oxygen curve, type I assimulation curves, and areal production values at Moncove are characteristic of eutrophic lakes.

75-000060 Volkmar, R. D. (Dep. Biol., W.Va. Univ., Morgantown 26506) PRIMARY PRODUCTIVITY IN RELATION TO CHEMICAL PARAMETERS IN CHEAT LAKE, WEST VIRGINIA. Proc. W.Va. Acad. Sci. 44 (1): 14-22. 1972. SFA 20(3).

Primary productivity and chemical parameters were investigated in Cheat Lake and two of its backwater areas during the summer and autumn of 1971. The main lake showed high acidity and conductivity, and low pH, alkalinity, and inorganic carbon, indicating the presence of acid mine wastes. The backwater areas have a pH near neutrality with low acidity and higher levels of bicarbonate alkalinity and inorganic carbon.

Rates of carbon assimilation were found not to be significantly different between the Rubles backwater and the lake proper, even though the two sites are vastly different with regard to water chemistry. Regression analyses showed productivity at the two sites to be under the influence of different factors. At the dam station the acid content of the water exerts considerable influence on the rate of carbon assimilation. In contrast, inorganic carbon was the most important variable controlling productivity in the Rubles backwater. Subsequent investigation is needed before precise relationships can be defined.

MORPHOLOGY

75-000061 Johnson, R. K.; Barnett, M. A. (Div. Fish., Field Mus. Nat. Hist., Chicago, IL 60605) AN INVERSE CORRELATION BETWEEN MERISTIC CHARACTERS AND FOOD SUPPLY IN MID-WATER FISHES: EVIDENCE AND POSSIBLE EXPLANATIONS. NOAA Fish. Bull. 73 (2) 284-298. Apr. 1975. SFA 20(3).

In five species of mid-water fishes, /Chauliodus sloani/ /Diplophos taenia/, /Pollichthys mauli/, /Vinciguerria lucetia/, and /V. nimbaria/, the central values of meristic counts (anal fin rays, vertebrae, longitudinal photophore rows) and three measures of biological productivity (phosphate-phosphorus concentration, net primary production, zooplankton standing stocks) are correlated negatively. For the species and areas studied the meristic variation observed cannot be related to temperature, salinity, dissolved oxygen, or any other physical or chemical factor known to affect meristic variation in fishes. It is hypothesized that this relationship between meristic counts and measures of food availability involves differences in egg size, fecundity, size at hatching, and size at comparable stages of larval development between populations in different areas, and that these differences in turn reflect adaptations to low food densities in areas of low productivity and higher predator densities in areas of higher productivity.

75-000062 Leino, R. L. (Dep. Biomed. Anat., Univ. Minn., Duluth) ULTRASTRUCTURE OF IMMATURE, DEVELOPING, AND SECRETORY RODLET CELLS IN FISH. Cell Tiss. Res. 155 (3): 367-381. 1974. SFA 20(3).

Rodlet cells from many species of fresh water fish were examined with the electron microscope. Observations of these cells in the epithelia of intestine, gill, and other organs favor the interpretation that rodlet cells are secretory cells rather than protozoan parasites (/Rhabdospora thelohani/). Evidence is presented that rodlet cells develop from undifferentiated cells near the epithelial basement membranes and migrate "upward" to secrete their contents in a holocrine manner at the epithelial surface. The major secretory product is packaged in unique club-shaped sacs which contain a central core of highly electron dense material with less dense material surrounding it. Secretion often appears to be accomplished by active contraction of a 0.5 um fibrillar border resembling smooth muscle which lies just inside of the plasma membrane. Some rodlet cells, however, merely break apart and release their contents.

75-000063 O'Connor, J. F.; Coad, B. W. (Dep. Mines, Resour., Environ. Manage., 989 Century St., Winnipeg, MB R3H 0W4, Can.) ANOMALIES OF THE ADIPOSE AND PELVIC FINS OF A BROOK TROUT, /SALVELINUS FONTINALIS/. Trans. Am. Fish. Soc. 104 (2): 414. Apr. 1975. SFA 20(3).

75-000064 Talent, L. G. (Moss Landing Mar. Lab., Moss Landing, CA 95039) PUGHEADEDNESS IN THE LONGSPINE COMBFISH, /ZANICLEPIS LATIPINNIS/, FROM MONTEREY BAY, CALIFORNIA. Calif. Fish Game 61 (3): 160-162. July 1975. SFA 20(3).

75-000065 Wenner, C. A. (Virginia Inst. Mar. Sci., Gloucester Point 23062) THE OCCURRENCE OF ELVERS OF /SYNAPHOBRANCHUS AFFINIS/ ON THE CONTINENTAL SLOPE OFF NORTH CAROLINA. NOAA Fish. Bull. 73 (3): 687-691. July 1975. SFA 20(3).

A total of 89 elvers of /Synaphobranchus affinis/ were collected with a 30-ft shrimp trawl. Vertebral counts had a mode of 134. Mean length of elvers was 89 mm, and 72.5 percent had osteological deformities associated with the vertebral column. Such deformities were also found in 60 percent of a sample of larger (mean total length 220 mm) elvers collected on another date. Twelve of forty elvers examined had material in the gut, with fish and crustacean predominating (RS)

PHYSIOLOGY

75-000066 Balsano, J. S.; Rasch, E. M. (Div. Sci., Univ. Wis.-Parkside, Kenosha 53140) MODIFICATION OF ACRYLAMIDE ELECTROPHORESIS FOR MICROSPECTROPHOTOMETRIC ANALYSIS OF FISH PLASMA PROTEINS. Trans. Am. Fish. Soc. 104 (1): 150-157. Jan. 1975. SFA 20(3).

A technique for discontinuous electrophoresis that permits rapid and direct comparisons of multiple samples in thin sheets of polyacrylamide gel is described. The resulting electropherograms are suitable for screening for enzyme polymorphisms and for densitometric scanning and/or direct photographing after gels are stained for total proteins.

Each gel sheet (110 X 90 X 0.8 mm) can be used for simultaneous separation of 10-15 different samples. Since total voltage and the running time required for successful resolution of fine protein bands are reduced in this system, minimal heating occurs within the gel matrix during electrophoresis. Up to 120 different blood samples (8 gel sheets) can be processed in about 8 hrs. Gels are stained overnight in Coomassie Brilliant Blue, rinsed several times and stored in 7 percent acetic acid. Particular gel sectors are then transferred to distilled water and mounted on glass microslides for photography or for densitometric evaluation with a Leitz microspectrophotometer. This technique has evolved during the past decade to become an effective and efficient method to identify characteristic differences in the electrophoretic mobilities of plasma enzymes and albumin fractions from several populations of poeciliid fishes.

75-000067 Bouck, G. R.; Schneider, P. W., Jr.; Jacobson, J.; Ball, R. C., (Western Fish Toxicol. Sta. (EPA), Corvallis, OR 97330) CHARACTERIZATION AND SUBCELLULAR LOCALIZATION OF LEUCINE AMINONAPHTHYLAMIDASE (LAN) IN RAINBOW TROUT (/SALMO GAIRDNERI/). J. Fish Res. Board. Can. 32 (8): 1289-1295. Aug. 1975. In English with French summ. SFA 20(3).

LAN analyses appear to have diagnostic value in fish pathobiology and studies were undertaken to determine optima for substrate concentration, pH, reaction time, temperature, and buffer ions. Citrate ion did not inhibit LAN at anticoagulant levels, but cyanide, pyrophosphate, and EDTA had an inhibitory effect. Storage of samples at -10 and 1 C resulted in small but significant reductions of LAN activity, while at room temperature enzyme activity was rapidly lost. LAN activity was distributed among liver fractions as follows: microsomes, 12 percent; mitochondria, 9 percent; cellular sap, 37 percent; other, 50 percent. Three isozymes of LAN were found. Blood plasma contained significant amounts of LAN activity which was significantly higher in cold- than in warm-acclimated fish. However, these LAN levels were comparable when their activity was extrapolated

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to body temperatures.

75-000068 Drongowski, R. A.; Wood, J. S.; Bouck, G. R. (Dep. Biol., West. Mich. Univ., Kalamazoo, 49008) THYROID ACTIVITY IN COHO SALMON FROM OREGON AND LAKE MICHIGAN. Trans. Am. Fish. Soc. 104 (2): 349-352. Apr. 1975. SFA 20(3).

Blood and thyroid tissue samples were compared among adult, jack, and smolt coho salmon from Oregon and Lake Michigan. Blood samples were analyzed for thyroxine and triiodothyronine, and thyroid tissue was examined histologically. Significant differences in estimates of thyroxine and triiodothyronine levels and histological condition indicated that Lake Michigan jack and adult coho salmon were hypothyroid. The authors theorize that the hypothyroid condition is related to the general iodine deficiency in the Great Lakes Region, contributes to the lower fertility and fecundity of the Great Lakes salmon, and exaggerates pesticide accumulation in the fish.

75-000069 Dudley, R. G.; Eipper, A. W. (Sch. Forest Resour., Univ. Ga., Athens 30602) SURVIVAL OF LARGEMOUTH BASS EMBRYOS AT LOW DISSOLVED OXYGEN CONCENTRATIONS. Trans. Am. Fish. Soc. 104 (1): 122-128. Jan. 1975. SFA 20(3).

We identified the low oxygen concentrations that significantly decreased survival of largemouth bass (/Micropterus salmoides/) embryos incubated at three temperatures in both stationary and moving containers. Embryos developed and hatched at oxygen concentrations as low as 1.0, 1.1, and 1.3 mg/liter at temperatures of 15, 20, and 25 C, respectively, but concentrations below 2.0, 2.1, and 2.8 mg/liter significantly lowered survival. Most mortality at these oxygen concentrations occurred during hatching. At oxygen concentrations below 1.0 mg/liter, survival during the prehatching period was higher among those groups of embryos that were moved slowly up and down during incubation than among unmoved embryos; however, moved embryos suffered nearly complete mortality during hatching at all oxygen concentrations.

75-000070 Eldridge, M. B. (NMFS, Tiburon Fish. Lab., Tiburon, CA 94920) EARLY LARVAE OF THE DIAMOND TURBOT, /HYPSOPSETTA GUTTULATA/. Calif. Fish Game 61 (1): 26-34. Jan. 1975. SFA 20(3).

A developmental series of larvae of /Hypsopsetta guttulata/ collected in San Francisco Bay is described. These larvae are very similar to /Pleuronichthys/ turbots and distinguishing characters which separate larvae forms of /Hypsopsetta/ from /Pleuronichthys/ are discussed. Occurrences of /H. guttulata/ eggs and larvae indicate an extended spawning period from early June through mid-October.

75-000071 Graham, J. B. (Smithsonian Trop. Res. Inst., P.O. Box 2072, Balboa, Canal Zone) HEAT EXCHANGE IN THE YELLOWFIN TUNA, /THUNNUS ALBACARES/, AND SKIPJACK TUNA, /KATSUWONUS PELAMIS/, AND THE ADAPTIVE SIGNIFICANCE OF ELEVATED BODY TEMPERATURES IN SCOMBRID FISHES. NOAA Fish. Bull. 73 (2): 219-229. Apr. 1975. SFA 20(3).

/Thunnus albacares/ and /Katsuwonus pelamis/ are warm-bodied fish and use retia mirabilia as countercurrent heat exchangers. Both species have four sets of lateral exchangers, two epaxial and two hypaxial, each consisting of a large cutaneous artery and vein and rete. /Katsuwonus pelamis/ has a central exchanger, located within the haemal arch, which consists of the dorsal aorta, the posterior cardinal vein, and a large vertical rete. The central heat exchanger in /T. albacares/, while also in the haemal arch, is simpler, consisting of two small "wing-shaped" retia on either side of the

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dorsal aorta and cardinal vein.

The adaptive significance of the specialization for heat conservation is discussed. Body temperatures, thermal profiles, and the natural histories of different warm-bodied species are compared, and warm fishes are contrasted with scombrids that do not conserve heat. The skipjack tunas, /Euthynnus/ and /Katsuwonus/, have well-developed central heat exchangers and are much warmer than /T. albacares/. Higher body temperatures in skipjacks seems related to their requirement for a higher basal swimming speed and their faster burst speed.

Comparisons on the basis of existing knowledge about the two phyletic groups of /Thunnus/ reveal few differences in swimming ability or factors related to locomotion. The bluefin group, consisting of /T. thynnus/, /T. maccoyii/, and /T. alalunga/, however, does contrast latitudes.

75-000072 Houde, E. D.; Swanson, L. J., Jr. (Rosenstiel Sch. Mar. Atmos. Sci., Univ. Miami, Miami, FL 33149) DISCRIPTION OF EGGS AND LARVAE OF YELLOWFIN MENHADEN, /BREVOORTIA SMITHI/. NOAA Fish. Bull. 73 (3): 660-673. July 1975. SFA 20(3).

Development of yellowfin menhaden, /Brevoortia smithi/, is described from eggs and larvae reared in the laboratory. Eggs were collected during November 1972 in Biscayne Bay, Florida. Eight embryos and 66 larvae and juveniles ranging from 3.7 to 36.2 mm standard length were used to describe development. Mean egg diameter was 1.27 mm, mean oil globule diameter was 0.15 mm, and mean yolk diameter was 1.07 mm. The perivitelline space averaged 16 percent of the egg diameter. Length at hatching was about 3.0 mm standard length. Larvae were fed on zooplankton and grew about 0.45 mm per day from the 4th until the 20th day after hatching at 26 degrees C. Morphology, meristics, osteology, and pigmentation are described. Transformation from larvae to juveniles apparently was completed at 20 to 23 mm standard length. During transformation full complements of fin rays were developed, the dorsal fin moved forward, the gut shortened, and the anal fin moved forward. Yellowfin menhaden larvae have some characteristics that serve to distinguish them from larvae of other clupeid genera occupying the same geographic range, and also have some characters that may be helpful to distinguish them from other species in the genus /Brevoortia/.

75-000073 Kendall, M. W.; Hawkins, W. E. (Dep. Anat., Sch. Med., Univ. Miss., Jackson 39216) HEPATIC MORPHOLOGY AND ACID PHOSPHATASE LOCALIZATION IN THE CHANNEL CATFISH (/ICTALURUS PUNCTATUS/). J. Fish. Res. Board Can. 32 (8): 1459-1464. Aug. 1975. In English with French summ. SFA 20(3).

Livers of 50 channel catfish (25-45 cm long) obtained by seining from the Ross Barnett Reservoir near Jackson, Mississippi were subjected to light, electron microscopic, and enzyme histochemical examination to describe the hepatic parenchyma and exocrine pancreas as well as localize acid phosphatase. Similar to that of other fish species, catfish liver parenchyma consisted of laminae of dual-plated muralium and, unlike that of many species, dispersed exocrine pancreatic tissue was observed circumscribing the portal vein, its tributaries, hepatic artery, and its branches. Acid phosphatase activity was histochemically localized to reaction product in lysosomal-like bodies arranged in peribiliary canalicular patterns. Electron microscopic observations were consistent with the above observations and biliary canaliculi were noted with long microvillar processes occupying their lumens. The exocrine pancreatic cells contained granular endoplasmic reticulum, free ribosomes, Golgi bodies, and numerous membrane-bound zymogen granules.

75-000074 Lied, E.; Gjerde, J.; Braekkan, O. R. (Govt. Vitamin Inst., Dir. Fish., N-5001 Bergen, Norway) SIMPLE AND RAPID TECHNIQUE FOR REPEATED BLOOD SAMPLING IN RAINBOW TROUT (/SALMO GAIRDNERI/). J. Fish. Res. Board Can. 32 (5): 699-701. May 1975. In English with French summ. SFA 20(3).

A method for repeated blood sampling from small as well as large fish by puncturing the duct of Cuvier is described. The method is simple and makes possible rapid sampling of relatively large volumes of blood. The method is thought to be less stressing for the fish than earlier methods described. Application of the technique to 20- and 300-g trout resulted in no deaths or apparent damage during a 1-mo observation period.

75-000075 Sikstrom, C. B.; Metner, D. A.; Lockhart, W. L. (Dep. Environ., 501 University Crescent, Winnipeg, MB R3T 2N6, Canada) HERMAPHRODITISM IN A WHITE SUCKER (/CATOSTOMUS COMMERSONI/) FROM THE ATHABASCA RIVER, ALBERTA. Trans. Am. Fish. Soc. 104 (2): 413. Apr. 1975. SFA 20(3).

75-000076 Stauffer, J. R.; Dickson, K. L.; Heath, A. G.; Lane, G. W; Cairns, J., Jr. (Cent. Environ. Estuarine Stud., Univ. Md., Lavale 21502) BODY TEMPERATURE CHANGE OF BLUEGILL SUNFISH WHEN SUBJECTED TO THERMAL SHOCK. Prog. Fish-Cult. 37 (2): 90-92. Apr. 1975. SFA 20(3).

The purpose of this study was to determine if differences between internal body temperature and surrounding water temperature could be used to determine residency time of fish in artifically heated water. The rate of body temperature change of bluegill sunfish (/Lepomis macrochirus/) was measured with a temperature sensitive transmitter while fish were subjected to a thermal shock. Fish exposed to 11.1 degrees C (20 degrees F) above acclimation required a mean of 476 s (range 420 to 510) to reach thermal equilibrium, while fish exposed to 11.1 degrees C below their acclimation required a mean of 525 s (range 450 to 570). Rate of blood flow may be an important factor which influenced the time required to reach thermal equilibrium. Due to the rapidity with which thermal equilibrium was reached and the probable influence of blood flow, body temperature did not appear to be a useful method for determining residency time. However, since heated waste water discharges are a major environmental factor, the rapid establishment of thermal equilibrium may be of significant importance.

75-000077 Wedemeyer, G. A.; Nelson, N. C. (U.S. FWS, Western Fish Disease Lab., Seattle, WA 98115) STATISTICAL METHODS FOR ESTIMATING NORMAL BLOOD CHEMISTRY RANGES AND VARIANCE IN RAINBOW TROUT (/SALMO GAIRDNERI/), SHASTA STRAIN. J. Fish. Res. Board Can. 32 (4): 551-554. Apr. 1975. In English with French summ. SFA 20(3).

Gaussian and nonparametric (percentile estimate and tolerance interval) statistical methods were used to estimate normal ranges for blood chemistry (bicarbonate, bilirubin, calcium, hematocrit, hemoglobin, magnesium, mean cell hemoglobin concentration, osmolality, inorganic phosphorus, and pH for juvenile rainbow (/Salmo gairdneri/, Shasta strain) trout held under defined environmental conditions. The percentile estimate and Gaussian methods gave similar normal ranges, whereas the tolerance interval method gave consistently wider ranges for all blood variables except hemoglobin. If the underlying frequency distribution is unknown, the percentile estimate procedure would be the method of choice.

GENETICS, VARIATION STUDIES AND HYBRIDIZATION

75-000078 Avtalion, R. R.; Pruginin, Y.; Rothbard, S. (Dep. Life Sci., Bar-Ilan Univ., Ramat Gan, Israel) DETERMINATION OF ALLOGENEIC AND XENOGENEIC MARKERS IN THE GENUS OF TILAPIA: I. IDENTIFICATION OF SEX AND HYBRIDS IN TILAPIA BY ELECTROPHORETIC ANALYSIS OF SERUM PROTEINS. Bamidgeh 27 (1): 8-13. Mar. 1975. SFA 20(3).

Sera from /T. vulcani/, /T. galilaea/, /T. aurea/ and /T. nilotica/, and from F-1 hybrid males of /T. aurea/ X /T. vulcani/ and /T. aurea/ X /T. nilotica/ were comparatively analysed using polyacrylamide gel electrophoresis.

Bands situated in the fast moving region of the electropherogram were found to be characteristic of both the species and the male-sex in /T. galilaea, /T. vulcani/ and /T. aurea/. No such bands could be identified in the studied stock of /T. nilotica/. In the studied F-1 hybrids they were absent or very weak. Two other bands (1 and 2) situated in the same region of the electropherogram were also found to be species specific and exist in both males and females. Band in position 1 was found to be specific for /T. aurea/ and /T. nilotica/, and band 2 for /T. vulcani/. Identification of hybrids was based on either simultaneous presence of bands 1 and 2 or on presence of one of the bands, in the electropherograms of the population tested, and on the polymorphism in the transferrin region of the electropherogram in which simultaneous presence of bands 8 and 9 was found only in hybrids. The identification of /T. aurea/ X /T. nilotica/ hybrids was found to be difficult, since /T. nilotica/ presented a high polymorphism in bands 5-9 and possessed the same band 1 as /T. aurea/. (Auth. Summ.)

75-000079 Carscadden, J. E.; Leggett, W. C. (Leggett, W. C.: Biol. Dep., McGill Univ., Montreal, QU H3C 3G1, Can.) MERISTIC DIFFERENCES IN SPAWNING POPULATIONS OF AMERICAN SHAD, /ALOSA SAPIDISSIMA/: EVIDENCE FOR HOMING TO TRIBUTARIES IN THE ST. JOHN RIVER, NEW BRUNSWICK. J. Fish. Res. Board Can. 32 (5): 653-660. May 1975. In English with French summ. SFA 20(3).

Univariate and multivariate analyses were performed on five meristic characters of American shad, /Alosa sapidissima/, spawning in the Miramichi, St. John, Connecticut, and Hudson rivers. In 71 percent of the comparisons, significant differences in mean numbers of meristic characters existed between river populations and between tributaries within the St. John River system. Comparisons of populations using multivariate techniques revealed that percentage of overlap of meristic characters was low (less than 1 percent in most comparisons). It is suggested that shad not only home to their natal river but also to their natal tributary. The results suggest that in shad, meristic counts are strongly influenced by a genetic component.

75-000080 Messieh, S. N. (Dep. Environ., Biol. Sta., St. Andrews, NB E0G 2X0, Can.) DELINEATING SPRING AND AUTUMN HERRING POPULATIONS IN THE SOUTHERN GULF OF ST. LAWRENCE BY DESCRIMINANT FUNCTION ANALYSIS. J. Fish. Res. Board Can. 32 (4): 471-477. Apr. 1975. In English with French summ. SFA 20(3).

A discriminant function based on three variables, pectoral and dorsal fin rays and gill rakers, was calculated for Atlantic herring (/Clupea harengus harengus/) taken from spring- and autumn-spawning concentrations in the southern Gulf of St. Lawrence and tested for general applicability by classifying other herring of known origin. The function was then used to classify herring sampled from feeding

75-000080 CONTINUED
concentrations. Results showed that feeding herring (pre- and postspawning) comprised a mixture of spring and autumn herring populations averaging 51.8 and 48.2 percent, respectively.
The observed heterogeneity of feeding concentrations, in contrast to homogeneity of spawning concentrations, confirmed the hypothesis that spring and autumn herring populations mix during feeding, though they separate at the onset of spawning. Discriminant function analysis is most useful for separating herring spawning groups during their feeding season when overlap of maturation stages prevents separation by maturation stage alone.

75-000081 Mighell, J. L.; Dangel, J. R. (Northwest Fish. Cent., NMFS, 2725 Montlake Blvd. E., Seattle, WA 98112) HATCHING SURVIVAL OF HYBRIDS OF /ONCORHYNCHUS MASOU/ WITH /SALMO GAIRDNERI/ AND WITH NORTH AMERICAN SPECIES OF /ONCORHYNCHUS/. NOAA Fish. Bull. 73 (2): 447-449. Apr. 1975. SFA 20(3).
Hybridization experiments showed that crosses of cherry salmon with chum, chinook, and pink salmon, and with rainbow trout were highly successful whereas crosses with coho and sockeye salmon were less successful. (RS)

75-000082 Wilson, J. L. (Agric. Exp. Sta., Univ. Tenn., Knoxville 37916) HEMOGLOBIN COMPARISONS OF GREEN SUNFISH (/LEPOMIS CYANELLUS/ RAFINESQUE) X BLUEGILL (/L. MACROCHIRUS/ RAFINESQUE) HYBRIDS TO THE PARENTAL SPECIES. Trans. Am. Fish. Soc. 104 (1): 148-149. Jan. 1975. SFA 20(3).
The comparison of the electrophoretic patterns of hemoglobins of individual parent species (green sunfish and bluegill) and a mixture of parental hemolysates to that of the F(1) hybrids revealed that the hybrid contained at least one detectable hemoglobin component which differed from those of the parental mixture.

BEHAVIOR

75-000083 Cherry, D. S.; Dickson, K. L.; Cairns, J., Jr. (Center Environ. Stud., VPI & SU, Blacksburg, VA 24061) TEMPERATURES SELECTED AND AVOIDED BY FISH AT VARIOUS ACCLIMATION TEMPERATURES. J. Fish. Res. Board Can. 32 (4): 485-491. Apr. 1975. In English with French summ. SFA 20(3).
Temperatures selected and avoided by 13 fish species, evaluated at decreasing increments of 3 C from 30 to 6 C, declined as the acclimation temperature decreased from summer to winter. As acclimation levels declined the difference between acclimation and selected temperatures increased for centrarchids and cyprinids, whereas the difference between these two temperatures increased for trout above and below the 18 C level of acclimation. Bluegill (/Lepomis macrochirus/) and spotted bass (/Micropterus punctulatus/) selected the highest temperatures at all acclimation levels, followed by channel catfish (/Ictalurus punctatus/), green sunfish (/Lepomis cyanellus/), smallmouth bass (/Micropterus dolomieui/), spotfin shiner (/Notropis spilopterus/), and other cyprinids. Rainbow (/Salmo gairdneri/) and brook (/Salvelinus fontinalis/) trout selected the lowest temperatures. A linear regression of the selection vs. the acclimation temperatures was plotted for cyprinids, centrarchids, and salmonids.
As the acclimation temperature was lowered, temperatures avoided decreased and the difference between the upper and lower avoidance range increased at each acclimation level. Eurythermal species,

75-000083 CONTINUED
centrarchids, ictalurids, and most cyprinids, generallly had a range difference of at least 10 C or more between the upper and lower avoidance temperature at each acclimation level.

75-000084 Follett, W. I. (Calif. Acad. Sci., San Francisco 94118) ATTACKS BY THE WHITE SHARK, /CARCHARODON CARCHARIAS/ (LINNAEUS), IN NORTHERN CALIFORNIA. Calif. Fish Game 60 (4): 192-198. Oct. 1974. SFA 20(3).

This is a report on three shark attacks in northern California: an attack on a skin diver by a white shark in the channel between Bird Rock and Tomales Point, Marin County; an earlier attack on a skin diver, presumably by a white shark, at the same place; and an attack on a fishing boat by a white shark off Del Norte County.

75-000085 Odenweller, D. B. (Calif. Dep. Fish Game, 3900 N. Wilson Way, Stockton 95205) AN UNUSUAL AGGREGATION OF BAT RAYS, /MYLIOBATIS CALIFORNICA/ GILL. Calif. Fish Game 61 (3): 159. July 1975. SFA 20(3).

75-000086 Peterson, R. H. (Dep. Environ., Biol. Sta., St. Andrews, NB E0G 2X0, Can.) PECTORAL FIN AND OPERCULAR MOVEMENTS OF ATLANTIC SALMON (/SALMO SALAR/) ALEVINS. J. Fish. Res. Board Can. 32 (5): 643-647. May 1975. In English with French summ. SFA 20(3).

The pectoral fins of Atlantic salmon (/Salmo salar/) alevins change in shape and orientation as development proceeds. They flutter rhythemically at 100-150/min whereas opercula move infrequently in newly hatched alevins. Ablation of pectoral fins induces increased opercular movements. Rhythmic movements of the pectoral fins displace water from the posterior edge of the opercula to the area immediately behind the fins. The frequency of pectoral movements is influenced by changes in ambient PO(2). The pectoral movements are probably useful in generating water currents around the alevin in the gravel interstices.

75-000087 Webb, P. W. (Dep. Environ., Pacific Biol. Stn., Nanaimo, BC V9R 5K6, Canada) HYDRODYNAMICS AND ENERGETICS OF FISH PROPULSION. Bull. Fish. Res. Board Can. 190. x + 159p. 1975. In English with French summ. SFA 20(3).

The object of this monograph is to span the gap between biological and physical science approaches to fish propulsion problems. An attempt is made to summarize and collate the two principal disciplinary approaches as a basis for dialogue and ongoing research.

Principles of hydrodynamics are discussed, oriented to biologists. Following a discussion of kinematics and swimming perfcrmance, the hydrodynamic principles are applied in discussing the fundamental problem of drag and thrust. The traditionally employed rigid-body analogy (theoretical drag calculation for equivalent rigid bodies or dead-drag measurements on fish with the body stretched straight) is not considered a valid assumption from which swimming thrust (= drag) power may be computed. Movements made by most fish during swimming are likely to severely distort flow. As a result, the flow around a swimming fish is not likely to be mechanically equivalent to that assumed by the rigid-body analogy.

Alternative methods of calculating thrust power from hydrodynamic models based on the movements of swimming fish are discussed.

A variety of mechanisms to reduce the drag of swimming fish has been proposed in the literature. Only a few are likely to operate. These include special body shapes in fish that swim with the bulk of the body held fairly straight, distributed dynamic damping in /Desmodema/,

75-000087 CONTINUED
distributed viscous damping possibly in cetaceans, induction and maintenance of turbulent boundary-layer flow to avoid premature separation, vortex sheets filling fin gaps, and vortex interaction among schooling fish. Mucus may be a universal drag-reducing mechanism among fish.

Principles of biological energy metabolism are discussed oriented to nonbiologists. Biological energetics and mechanics are integrated in a discussion of propulsion efficiency. The use of hydromechanical models is supported providing reasonably complete data are available. Efficiency studies emphasize biological areas requiring additional research.

Discussion is largely restricted to caudal fin and body propulsion at relatively low activity levels. Few data are available for other propulsion modes. A preliminary model is constructed to describe mechanical energy expenditure during acceleration. This suggests that highest final swimming speeds are reached in the shortest time with lowest energy expenditure at highest acceleration rates. (From Auth. Abstr.)

LIFE HISTORIES-GENERAL WORKS

75-000088 Campbell, K. P.; Peck, T. H.,; McLaren, J. B.; Nittel, M. (Texas Instruments Inc., Ecol. Serv., P.O. Box 237, Buchanan, NY 10511) BIOLOGY OF THE ATLANTIC TOMCOD /MICROGADUS TOMCOD/ IN THE HUDSON RIVER. Presented at the 105th Annu. Meeting, Am. Fish. Soc., Las Vegas, Nev. 10-13 Sept. 1975. Abstract only. SFA 20(3).

The biology of the Atlantic tomcod in the Hudson River was investigated in 1973, 1974, and early 1975 to provide information on the population dynamics and food habits of the species. Information is presented on the distribution and abundance of early juveniles and mark/recapture population estimates are provided for mature fish during the winter spawning season. Analysis of juvenile growth rates indicate retarded growth during the summer which results in a scale mark about 6 months after hatching that could be misinterpreted as an annulus. Examination of age and length frequency data from the spawning season indicates that at least 99 percent of the spawners are from the year class produced in the previous spawn. The relationship between total length and fecundity was determined as log(10) fecundity = 1.552 + 2.536 log(10) total length (mm). The principal food items taken by tomcod were invertebrates, e. g. copepods, amphipods, and polychaetes. This preliminary assessment indicates that the Hudson River population of Atlantic tomcod had a high mortality rate and rapid growth rate with sexual maturity occurring in the first year.

75-000089 Craig, P. C.; Poulin, V. A. (Aquatic Environ. Ltd., Box 414, Crossfield, Alta. T0M 0S0, Can.) MOVEMENTS AND GROWTH OF ARCTIC GRAYLING (/THYMALLUS ARCTICUS/) AND JUVENILE ARCTIC CHAR (/SALVELINUS ALPINUS/) IN A SMALL ARCTIC STREAM, ALASKA. J. Fish. Res. Board Can. 32 (5): 689-697. May 1975. In English with French summ. SFA 20(3).

Fish movements were monitored in a small arctic stream that drains into the Kavik River near Prudhoe Bay, Alaska. The stream, which flows only during summer, served as a spawning and nursery area for Arctic grayling (/Thymallus arcticus/). Adult grayling entered the stream shortly after breakup and left again after spawning. Juvenile grayling also entered soon after breakup and many remained throughout the summer. Grayling fry emerged from the gravel in late June or early July and remained until freeze-up (mid-September). Small numbers of Arctic char (/Salvelinus alpinus/) juveniles also entered the stream to feed.

75-000089 CONTINUED
The growth rate of grayling in the study stream was among the fastest recorded for arctic populations. Otolith-based age determinations were preferred as scales tended to underestimate the ages of old fish. Maximum observed age was 16 and age at sexual maturity ranged from 5 to 8.

75-000090 Imler, R. L.; Weber, D. T.; Fyock, O. L. (Colo. Div. Wildl., Ft. Collins 80521) SURVIVAL, REPRODUCTION, AGE, GROWTH, AND FOOD HABITS OF SACRAMENTO PERCH, /ARCHOPLITES INTERRUPTUS/ (GIRARD), IN COLORADO. Trans. Am. Fish. Soc. 104 (2): 232-236. Apr. 1975. SFA 20(3).
Breeding populations of Sacramento perch, /Archoplites interruptus/ (Girard), were successfully established in four Colorado lakes of widely varied chemistries and differing fish faunas. Growth rates and length-weight relationships of /A. interruptus/ in Colcrado are comparable to those of the species in other states. Dipterans are the most prevalent summer food, although the Sacramento perch occasionally is cannibalistic on its young of the year.

75-000091 Mathews, C. P. (Dep. Fish. Oceanogr., Esc. Super. Cienc. Mar. Ensenada, B. C., Mexico) NOTE ON THE ECOLOGY OF THE RATFISH, /HYDROLAGUS COLLEI/, IN THE GULF OF CALIFORNIA. Calif. Fish Game 61 (1): 47-53. Jan. 1975. In English with Spanish summ. SFA 20(3).
/Hydrolagus collei/, the ratfish, has been taken frequently in the northern Gulf of California. This species shows a marked migratory pattern being relatively abundant and widely distributed in this area in February-March, and found at few stations and in low numbers in June and August. Males appear to grow more slowly than females and are less frequent in the catches. The breeding season must be several months before or after the period of spring abundance in the northern Gulf.

75-000092 Moores, J. A.; Winters, G. H.; Parsons, L. S. (Dep. Environ., Biol. Sta., St. John's, Nfld. A1C 1A1, Can.) MIGRATIONS AND BIOLOGICAL CHARACTERISTICS OF ATLANTIC MACKEREL (/SCOMBER SCOMBRUS/) OCCURRING IN NEWFOUNDLAND WATERS. J. Fish. Res. Board Can. 32 (8): 1347-1357. Aug. 1975. In English with French summ. SFA 20(3).
Mackerel migrate to Newfoundland waters from July to November and exhibit periodic fluctuations in abundance. Recent taggings have shown extensive migrations from Newfoundland to ICNAF Statistical Area 6. Various biological characteristics of mackerel from Newfoundland waters are reported and compared with those for mackerel caught in the New England area. A consideration of tagging results, biological characteristics, and ecological factors indicates that for assessment purposes mackerel inhabiting ICNAF Subareas 3-6 should be treated as one stock rather than assessed separately as northern and southern contingents each with a separate quota.

75-000093 Moulton, L. L. (Friday Harbor Lab. Fish. Res. Inst., Univ. Wash., Seattle 98195) LIFE HISTORY OBSERVATIONS ON THE PUGET SOUND ROCKFISH, /SEBASTES EMPHAEUS/ (STARKS, 1911). J. Fish. Res. Board Can. 32 (8): 1439-1442. Aug. 1975. In English with French summ. SFA 20(3).
Large concentrations of Puget Sound rockfish (/Sebastes emphaeus/) were found at three locations in the San Juan Islands, Washington, at depths ranging from 10 to 25 m. Spawning females were found in August and September, the latest maturing /Sebastes/ in this regicn. The existence of ripe females indicates that the taxon is not the juvenile form of another species. Total lengths of mature females ranged from

75-000093 CONTINUED
130 to 179 mm, and wet weights from 21 to 79 g. Fecundity estimates ranged from 20,177 for a 150-mm female to 57,103 for a 179-mm specimen. The age at maturity ranged from age II to age IV. Field and aquarium behavioral observations indicate that the species is adapted to crevice and cave existence in areas of strong currents and rocky substrate.

75-000094 Pettit, S. W.; Wallace, R. L. (Idaho Fish Game Dep., Lewiston 83501) AGE, GROWTH, AND MOVEMENT OF MOUNTAIN WHITEFISH, /PROSOPIUM WILLIAMSONI/ (GIRARD), IN THE NORTH FORK CLEARWATER RIVER, IDAHO. Trans. Am. Fish. Soc. 104 (1): 68-76. Jan. 1975. SFA 20(3).

The growth and age structure of mountain whitefish, /Prosopium williamsoni/, was compared from three sample locations in the North Fork Clearwater River, and a tagging study initiated to assess movement and migratory behavior. No difference was detected in growth or age structure of whitefish in two streams of the upper drainage, and juveniles representing age groups I and II were generally absent from upper river populations. Age groups I and II whitefish from the lower North Fork Clearwater had significantly greater growth than similar fish from the upper river. The sample from the lower river contained whitefish as old as age IV, whereas fish to age XIV were found in the upper reaches.

Young-of-the-year whitefish which spent their first growing season in the upper river moved downstream in September, and apparently remained in the lower river until reaching sexual maturity. Mature whitefish moved upstream (82 km) in late spring and early summer, remained in the upper reaches until spawning in November, then, with the completion of spawning, moved downstream (88 km) to overwinter in the deeper pools of the lower river. Repeat homing by spawning adults was demonstrated by the return of tagged fish (37 percent) to a small tributary in the following year.

POPULATION STUDIES, PRODUCTION, ETC.

75-000095 Chittenden, M. E., Jr. (Dep. Wildl. Fish. Sci., Texas A&M Univ., College Station 77840) DYNAMICS OF AMERICAN SHAD, /ALOSA SAPIDISSIMA/, RUNS IN THE DELAWARE RIVER. NOAA Fish. Bull. 73 (3): 487-494. July 1975. SFA 20(3).

Adult American shad were collected by haul seining at regular intervals during the spring migrations from 1963 to 1965 and by collecting specimens from a fishkill in spring 1965. Supplementary sex and size composition data were obtained from summer rotenone sampling in 1961 and 1962.

Males tended to precede females in the spring run. Annual sex compositions were strongly male dominated from 1961 to 1963 and were strongly female dominated in 1964 and 1965. Repeat spawners composed 2.6 percent of 729 fish examined from 1963 to 1965. Age I and II were absent or virtually absent from the run. Males migrated upstream primarily at age IV and females at age V. Large runs during the early 1960's were based on the 1958 and 1959 year classes as defined which were much larger than other year classes produced in the period 1957-64. Delaware River American shad runs now have little buffering against fluctuations in abundance because few year classes are successful, few age groups support the run, and there are essentially no repeat spawners. Larger runs in the Deleware since 1925 and probably somewhat earlier, in general, were apparently based on one large year class and essentially no repeat spawners.

75-000096 Clady, M. D. (Dep. Nat. Resour., Cornell Univ., Ithaca, NY 14853) THE EFFECTS OF A SIMULATED ANGLER HARVEST ON BIOMASS AND PRODUCTION IN LIGHTLY EXPLOITED POPULATIONS OF SMALLMOUTH AND LARGEMOUTH BASS. Trans. Am. Fish. Soc. 104 (2): 270-276. Apr. 1975. SFA 20(3).

Harvests of 13 to 21 percent, mostly of larger, older fish, were imposed for two years on populations of smallmouth and largemouth bass (/Micropterus dolomieui/ and /M. salmoides/) that previously had been virtually unfished. Another population of smallmouth bass served as a control. Using trap nets, estimates of the number of bass and their size were made for one year before and two years after initial harvest. From these data annual natural mortality, growth, standing crop and procuction were computed. There were no strong and consistent changes in any parameter which could be attributed to reductions in numbers of fish. Changes in growth unrelated to population density apparently resulted in declines of ratios of production to biomass following harvest. Possible causes of the lack of compensatory responses to harvest include the relatively short pericd of study and time lag in changes in growth and mortality.

75-000097 Grove, T. L.; Berggren, T. J. (Texas Instruments Inc., Ecol. Serv., P.O. Box 237, Buchanan, NY 10511) A MULTIVARIATE APPROACH TO DETERMINING THE RELATIVE CONTRIBUTION OF THE HUDSON RIVER STRIPED BASS POPULATION TO THE ATLANTIC FISHERY. Presented at the 105th Annu. Meeting, Am. Fish. Soc., Las Vegas, Nev. 10-13 Sept. 1975. Abstract only. SFA 20(3).

A good deal of concern has been expressed by public interest groups and regulatory bodies as to potential reductions in the Atlantic striped bass fishery resulting from operation of power generating plants on the Hudson River. Determination of potential impact requires estimation of the relative contribution of the Hudson River stock to the Atlantic fishery. In 1974 studies were initiated tc examine the feasibility of assessing this contribution.

Spawning populations of the primary spawning rivers were sampled and meristic, morphometric, and biochemical characters were used to segregate striped bass from the various populations. Multivariate discriminant analysis allowed correct classification of eighty percent of the striped bass from a mixed sample into their respective populations.

A spatially and temporally stratified sampling design was instituted late in 1974 to collect a representative sample of the Atlantic striped bass fishery. Meristic, morphometric, and biochemical analyses were performed on the collected fish. Discriminant function analysis was used to assign a river of origin to each fish. Stratified estimates of the relative contribution of the Hudson River stock were made.

75-000098 Pedrin, O.; Shainberg, H. (Instituto Nacional de Pesca, Mexico City, Mexico) A BRIEF SURVEY OF SARDINE AND ANCHOVY POPULATIONS AT VIZCAINO BAY, AND OF THE SARDINE FISHERY OF CEDROS ISLAND, BAJA CALIFORNIA. Calif. Fish Game 60 (4): 199-204. Oct. 1974. In English with Spanish summ. SFA 20(3).

A survey of sardines and anchovy populations of central and northern Baja California, complimented with samples and statistics cf landings at Cedros Island in September and October, 1972, showed a definite decline in available stocks of sardines and a corresponding increase in the anchovy population, resulting in a decline in sardine catches at Cedros Island. Age determination revealed a lack of young sardines and an extraordinary abundance of young of the year anchovies.

75-000099 Petrosky, C. E.; Waters, T. F. (Ichthyol. Assoc., Fricks Lock Road, R.D. 1, Pottstown, PA 19464) ANNUAL PRODUCTION BY THE SLIMY SCULPIN POPULATION IN A SMALL MINNESOTA TROUT STREAM. Trans. Am. Fish. Soc. 104 (2): 237-244. Apr. 1975. SFA 20(3).

Annual production by the slimy sculpin, /Cottus cognatus/ Richardson, was estimated at 59.4 kg/hectare wet weight for the period July, 1970, to July, 1971, in Valley Creek, Minnesota. Mark-and-recapture population estimates made by electrofishing and aging with otoliths were the bases for determining mean biomass and instantaneous growth rates. Annual turnover ratio, i.e., ratio of annual production to mean standing crop, was 1.2. Unusual silt and turbidity conditions, occurring in 1971, reduced the 1971 year class drastically, but had less serious effects on total production by all age groups. Food of the sculpins was similar in most respects to that of the brook trout inhabiting the same stream. Young sculpins fed heavily on small dipterans, mainly chironomids; older sculpins fed mainly on /Gammarus/ and Trichoptera larvae. Comparisons with annual production estimates for brook (/Salvelinus fontinalis/) and rainbow trout (/Salmo gairdneri/), made previously in Valley Creek for comparable time periods, suggested a normal total annual production for all fishes of about 200 kg/hectare, with sculpins contributing about 1/3 and trout about 2/3.

75-000100 Pitt, T. K. (Dep. Environ., Nfld. Biol. Sta., St. John's, Nfld. A1C 5X1, Can.) CHANGES IN ABUNDANCE AND CERTAIN BIOLOGICAL CHARACTERISTICS OF GRAND BANK AMERICAN PLAICE, /HIPPOGLOSSOIDES PLATESSOIDES/. J. Fish. Res. Board Can. 32 (8): 1383-1398. Aug. 1975. In English with french summ. SFA 20(3).

Commercial exploitation of American plaice on the Grand Bank increased from the early 1950s reaching a peak of about 90,000 tons in the mid-1960s. Catches have subsequently declined to about 45,000-50,000 tons annually. The increased exploitation of plaice was reflected in declines in catch per hour and stock abundance of fully vulnerable age-groups and an increase in the rate of instantaneous fishing mortality (F). The documentation of these was particularly strong in ICNAF Division 3L, but appeared to be somewhat erratic in 3N, probably because of incomplete sampling of the stock prior to the mid-1960s.

Average size at age increased gradually from the early 1950s to the 1970s apparently because of increased growth rate in the initial 2 or 3 yr of life. Coupled with the increased size at age were significant declines in the age at sexual maturity.

Significant correlations were found between stock abundance and asymptotic length (L_∞), and size at age 5 and 10 in Division 3L and while positive trends could be demonstrated between some of these and mean bottom temperature, the correlations were not significant.

75-000101 Silliman, R. P. (4135 Baker NW, Seattle, WA 98107) EFFECT OF CROWDING ON STOCK AND CATCH IN /TILAPIA MOSSAMBICA/. NOAA Fish. Bull. 73 (3): 685-686. July 1975. SFA 20(3).

Two identical populations of Tilapia mossambica/ were stocked in each of two aquaria, one with 1/2 the volume of the other. Recruitment was greater in the larger tank. Harvest of about 10 percent/2 mo suggested a greater yield from the larger tank under the same catch rate and food amount. (RS)

75-000102 Silliman, R. P. (4135 Baker NW, Seattle, WA 98107) SELECTIVE AND UNSELECTIVE EXPLOITATION OF EXPERIMENTAL POPULATIONS OF /TILAPIA MOSSAMBICA/. NOAA Fish. Bull. 73 (3): 495-507. July 1975. SFA 20(3).

Two populations of /Tilapia mossambica/ were grown under controlled conditions. After a period of growth and stabilization at about 10 kg and 200 fish, exploitation was started; about 50 fish of outside stock were added to each population to increase genetic variability.

Initial exploitation at 10 percent (later 20 percent) per 2 mo encompassed all sizes above fry in the unselectively fished population. In the selectively fished population, explcitation was practiced only on fish that could not pass through 25-mm (later 22-mm) vertical slots between glass bars.

Recruitment was estimated from data of stock, mortality, and catch. Parabolas fitted to the stock-recruitment relation suggested greater recruitment in the selectively fished stock than in the unselectively fished one.

Rectilinear thickness-length regressions were calculated for immature and male fish and separately for females.

The exploitation-yield relation was assessed by fitting Fox surplus-yield models to both populations. These revealed a greater maximum sustainable yield in weight from the unselectively fished population than from the selectively fished one. Efficiency of food conversion was 29-36 percent.

To test for genetic effect of selection, a group of 46 fish, matched as closely as possible in size and sex composition, was selected from each population. Growth in length over a period of 150 days was significantly greater among males from the unselectively fished population than among those from the selectively fished one. Growth in length of females was practically identical for both groups. Growth in total weight was distinctly greater for the group from the unselectively fished population than from the selectively fished one.

As applied to commercial fisheries, the experimental results suggested fishing as wide a range of sizes as possible. If economic gains from selection are indicated, they should be balanced against possible costs in reduced yield and retarded growth rate.

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

75-000103 Balon, E. K. (Dep. Zool., Univ. Guelph, Guelph, Ont. N1G 2W1, Can.) REPRODUCTIVE GUILDS OF FISHES: A PROPOSAL AND DEFINITION. J. Fish. Res. Board Can. 32 (6): 821-864. June 1975.

The emergence of efficient ecosystem modelling is severely hampered by the need for an ecological classification of fishes. An earlier concept of ecological groups is here expanded to cover all living fishes. This ecological classification is based mainly on form and function in early development intervals, on preferred spawning grounds, and on features of reproductive behavior. Within the adaptations for reproduction and embryonic development two factors prevail -- predators and the oxygen regime; consequently, spawning behavior and spawning grounds determine ensuing respiratory conditions and available protection from predators. The remaining factors are more or less associated with those two. From the point of view of resource exploitation, factors other than feeding habits governing density, biomass, and production are more important. In this sense reproductive guilds are more meaningful than feeding strategies, to which one usage of "guild" was limited.

Thirty-two guilds putatively encompass all the 30,000 living fish taxa (or about 20,000 species) and form an ecological classification unrelated to the Linnean classification. The guilds retain phyletic

75-000103 CONTINUED
significance in respect to reproductive systems and form a basis for the construction of models on natural and cultural succession. Number of guilds and frequency of taxa within guilds in a given area reflect geochronological sequences and invasion abilities of members of different guilds.

75-000104 Bennett, D. H.; Gibbons, J. W. (VPI & SU, Dep. Fish. Wildl., Blacksburg 24061) REPRODUCTIVE CYCLES OF LARGEMOUTH BASS (/MICROPTERUS SALMOIDES/) IN A COOLING RESERVOIR. Trans. Am. Fish. Soc. 104 (1): 77-82. Jan. 1975. SFA 20(3).
Annual reproductive cycles of largemouth bass (/Micropterus salmoides/) collected in the heated area of a 1120-hectare reservoir receiving thermal effluent were similar to cycles from bass collected in unheated waters during 1969 and 1970. Average maximum monthly temperatures at the heated area exceeded those in unheated waters by greater than 10 C for the 2 years. Few monthly differences in gonosomatic indices were found between heated and unheated areas. Earlier attainment of maximum gonadal size and the presence of significantly larger juvenile bass at the heated area suggested that reproduction might be accelerated by thermal discharge. However, gonadal condition indicated that the reproductive period started in March and continued through April in both areas. Reproduction may have been advanced in some heated-area bass, although this was not obvious from overall changes in the reproductive cycles of bass from unheated areas.

75-000105 Casselman, J. M. (Dep. Zool., Univ. Toronto, Toronto, Ont. M5S 1A1, Can.) SEX RATIOS OF NORTHERN PIKE, /ESOX LUCIUS/ LINNAEUS. Trans. Am. Fish. Soc. 104 (1): 60-63. Jan. 1975. SFA 20(3).
Sex ratios are presented for 4,802 northern pike captured by nets, electrofishing, and angling from three Ontario populations. Anglers captured more female than male northern pike (1.24:1) and a higher ratio of female fish than were taken by other methods (1.14:1). Regardless of method or region of capture, sex ratios showed similar seasonal trends. Males were relatively more abundant during two seasons--spring and autumn--when the sex ratios were approximately equal. Often 1.5 to 2.0 times as many females as males were present during summer and winter in anglers' catches and net samples. There was no significant difference between either the summer (1.44:1) and winter (1.27:1), or the spring (1.04:1) and autumn (0.98:1), sex ratios. The sexes appear to have biannual peaks of availability which are related to activity and are independent of locality and method of capture.

75-000106 Hansen, E. A. (N. Cent. Forest Exp. Sta., Cadillac, MI 49601) SOME EFFECTS OF GROUNDWATER ON BROWN TROUT REDDS. Trans. Am. Fish. Soc. 104 (1): 100-110. Jan. 1975. SFA 20(3).
A field study investigating the role of groundwater in trout spawning was conducted on Poplar Creek in northern Lower Michigan during 1969-1971. Seventy-eight natural brown trout (/Salmo trutta/) redds were instrumented with Mark VI standpipes during the study. Three Vibert boxes, each containing 100 fertilized brown trout eggs, were buried near each standpipe. Periodic measurements were made of gravel permeability, apparent water velocity, dissolved oxygen, temperature, and sand content of the redd gravels. Extensive measurements showed temperatures of 8.5 to 10 C and dissolved oxygen contents of 2 to 8 mg/liter in the groundwater at considerable depth beneath the streambed. The density of redd was the same in areas with or without groundwater inflow. Where there was groundwater inflow, the trout preferred zones of intermediate surface-groundwater mix, but

75-000106 CONTINUED
avoided zones of undiluted groundwater inflow. Redds had higher and less variable temperatures as the percentage of groundwater increased. This resulted in earlier egg hatching. However, eggs survived in all redds regardless of the presence or absence of groundwater. Redds without groundwater inflow had temperatures closely approximating the generally colder surface water. There were no measurable changes in intragravel permeability, velocity, dissolved oxygen or sand content of the redds as groundwater inflow increased.

75-000107 Heidinger, R.; Imboden, F. (S. Ill. Univ., Carbondale 62901) REPRODUCTIVE POTENTIAL OF YOUNG-OF-THE-YEAR THREADFIN SHAD (/DOROSOMA PETENENSE/) IN SOUTHERN ILLINOIS LAKES. Trans. Ill. State Acad. Sci. 67 (4): 397-401. Dec. 1974. SFA 20(3).
Young-of-the-year threadfin shad (/Dorosoma petenense/) spawned in southern Illinois waters. The management potential of this fish is discussed.

75-000108 Holsapple, J. G.; Foster, L. E. (N.Y. Power Pool, 3890 Carman Rd., Schenectady 12303) REPRODUCTION OF WHITE PERCH IN THE LOWER HUDSON RIVER. N.Y. Fish Game J. 22 (2): 122-127. July 1975. SFA 20(3).
Information on reproduction of the white perch (/Morone americana/), derived from data collected between river miles 40 and 60 of the Hudson River Estuary in 1972, is presented and compared with that in the published literature. The estimated average number of eggs spawned ranged from 20,676 for 3-year-old fish t to 135,289 for 9-year-old fish. Among age II fish, less than 20 per cent of the males and none of the females were sexually mature. At age III, all males and 75 percent of the females had reached sexual maturity. Spawning activity during 1972 was most intense in early June when water temperatures were between 18 degrees and 20 degrees C.

75-000109 Ludwig, G. M.; Lange, E. L. (Dep. Zool., Univ. Hawaii, Honolulu 96822) THE RELATIONSHIP OF LENGTH, AGE, AND AGE-LENGTH INTERACTION TO THE FECUNDITY OF THE NORTHERN MOTTLED SCULPIN, /COTTUS B. BAIRDI/. Trans. Am. Fish. Soc. 104 (1): 64-67. Jan. 1975. SFA 20(3).
Effects of age, length, and age-length interaction on fecundity of the northern mottled sculpin, /Cottus b. bairdi/, were found to be significant ($p = 0.05$) and to follow a curvilinear relationship. A statistical model using age, and age-length interaction may be a more accurate predictive tool than a model based on length alone.

75-000110 Nakatani, R. E.; Paulik, G. J.; VanCleve, R. (Fish Res. Inst. Coll. Fish., Univ. Wash., Seattle) PINK SALMON, /ONCORHYNCHUS GORBUSCHA/, TAGGING EXPERIMENTS IN SOUTHEASTERN ALASKA, 1938-42 AND 1945. NOAA Tech. Rep. NMFS SSRF-686. iv + 39p. Apr. 1975. SFA 20(3).

A total of 20,532 pink salmon (/Oncorhynchus gorbuscha/) were tagged and released in southeastern Alaska north of Sumner Strait during the years of 1938 to 1942 inclusive, and in 1945. The recovery of 7,027 of these tags in the fish traps confirmed the findings of other investigators that the pink salmon stocks of the northern part of southeast Alaska are separate from those in the southern part. They also show that pink salmon enter the northern part of southeast Alaska through two paths: (1) through Icy Strait, and (2) through the lower end of Chatham Strait. No evidence was found of movement through Peril Strait from Salisbury Sound into Chatham Strait. The centers of density of each group of tags appeared to move in a consistent manner,

75-000110 CONTINUED
but a smaller number of tags from each release were dispersed throughout the northern part of southeastern Alaska. Differences were noted between the movements of fish in odd and even years. Also a larger proportion of earlier tagged fish moved to recovery locations farther inland. In all areas and in all years the fishing season closed about the time of the greatest abundance of fish in the fishery, therefore the later parts of the runs were not studied. Apparently the 1941 run was the largest and that in 1945 the smallest. Migration rates were studied by plotting the catch per trap as well as by the recovery of tags. The latter showed movements of 9.05 to 33.37 miles per day. Survival rates computed for thirty releases with total tag recovery periods of two or more weeks averaged 0.384. Weekly exploitation rates varied from 0.142 to 0.452 averaging 0.250. The weekly F exponential rate of fishing averaged 0.514. Recoveries of tags from seines were not used since their proportion of tags recovered was less than one-half their proportion of the catch. Recommendations are made for future tagging experiments based upon the results of this analysis.

75-000111 Priegel, G. R.; Krohn, D. C. (Wis. Dep. Nat. Resour., Rt. 4, Madison 53711) CHARACTERISTICS OF A NORTHERN PIKE SPAWNING POPULATION. Wis. Dep. Nat. Resour., Tech. Bull. No. 86. 18p. 1975. SFA 20(3).

The northern pike spawning population in Gilbert Lake was studied in 1968 and 1969 to determine characteristics of northern pike spawning habitat, gain additional knowledge on early life history, describe characteristics of the spawning population, and determine the extent of angler harvest of the spawning population.

The combined northern pike spawning population in Gilbert and Big Cedar lakes consisted of 2,500-3,000 fish with about one-half spawning in Gilbert Lake. Immigration into the spawning areas began in mid-March and varied directly with water temperature and ice breakup on Gilbert Lake. The average sex ratio ranged from 1 female to 2.0-2.3 males.

Female northern pike grew at a faster rate than males. The growth rate of northern pike in these waters is exceptionally good compared to the growth of northern pike in other waters. Male and female northern pike were mature at age II. A wide range of size was observed among male and female northern pike of the same age.

Egg densities and hence, spawning activity, were related to vegetation type. Egg densities were greatest where dense sedge mats and wild celery remains were present.

Harvest data showed that from 11 May 1968 through 31 August 1970, 131 tagged fish were taken by anglers in Big Cedar Lake for a 17.6-percent return of the 744 fish originally tagged. The greatest number of tagged fish were caught in May and June. Females were considerably more susceptible to angling than males.

75-000112 Straty, R. R. (Northwest Fish. Cent., Auke Bay, AK 99821) MIGRATORY ROUTES OF ADULT SOCKEYE SALMON, /ONCORHYNCHUS NERKA/, IN THE EASTERN BERING SEA AND BRISTOL BAY. NOAA Tech. Rep. NMFS SSRF-690. iv + 32p. Apr. 1975. SFA 20(3).

The stocks of sockeye salmon, /Oncorhynchus nerka/, in Bristol Bay, Alaska, are produced in the lakes and streams of 10 major river systems, which discharge into the bay over a shoreline distance of 193 km.

The establishment of fishing areas, the determination when fishing may be permitted, and the effect of exploiting simultaneously several stocks of sockeye salmon require knowledge of the migratory pattern of the individual stocks comprising the run to Bristol Bay during spawning migration. Various mark-and-recapture experiments and

75-000112 CONTINUED
exploratory fishing in the eastern Bering Sea and Bristol Bay provide a picture of the migratory pattern of Bristol Bay sockeye salmon from approximately long. 170 degrees W to the head of Bristol Bay.

The main migration route of all stocks of Bristol Bay sockeye salmon is in the offshore waters of the southern half of the entrance to the bay and in the southern half of the bay itself. All stocks remain in the offshore waters until within 32 to 80 km of their home-river systems. Segregation according to river of origin apparently began in the offshore waters as much as 200 km from the mouths of the home-river systems and appeared to progress to the head of Bristol Bay.

75-000113 Tautz, A. F.; Groot, C. (Inst. Resour. Ecol., Univ. British Columbia, Vancouver, BC V6T 1W5, Can.) SPAWNING BEHAVIOR OF CHUM SALMON (/ONCORHYNCHUS KETA/) AND RAINBOW TROUT (/SALMO GAIRDNERI/). J. Fish. Res. Board Can. 32 (5): 633-642. May 1975. In English with French summ. SFA 20(3).

Detailed accounts of the spawning behavior of chum salmon (/Oncorhynchus keta/) and rainbow trout (/Salmo gairdneri/) in laboratory flumes are provided. The behavioral activities, quivering, probing, and crossing over increase in frequency as a function of time prior to spawning whereas digging remains constant or decreases slightly. Maps of digging locations and movie films suggest nest shape and current pattern are monitored by the female, allowing her to intensify her digging activity near the center of the nest. Probing appears to be a signal to the male indicating approach of oviposition and also provides information to the female regarding the shape and suitability of the nest site. The probing act is also used in the synchronization of the male and female spawning acts. Changes in velocity do not appear to markedly affect nest construction either in terms of number of digs to oviposition or in size of nest constructed. It is inferred that velocity and gravel size are important insofar as they influence the construction of a suitable nest depression. Nest sites would appear to be selected on the basis of acceleration of flow rather than velocity per se though high limits must obviously exist.

75-000114 Warner, R. R. (Smithsonian Trop. Res. Inst., P.O. Box 2072, Balboa, Canal Zone) THE REPRODUCTIVE BIOLOGY OF THE PROTOGYNOUS HERMAPHRODITE /PIMELOMETOPON PULCHRUM/ (PISCES: LABRIDAE). NOAA Fish. Bull. 73 (2) 262-283. Apr. 1975. SFA 20(3).

/Pimelometopon pulchrum/, California sheephead, a labrid fish of the eastern Pacific Ocean, was collected the year round at Catalina Island, Calif., and comparative material was taken at Guadalupe Island, Mexico. Individuals at Guadalupe were dwarfed relative to those at Catalina. /Pimelometopon pulchrum/ is a protogynous hermaphrodite, the ovarian elements undergoing massive degeneration as spermatogenic crypts proliferate in the gonads of transitional individuals. Sexual changes occur between breeding seasons. Individuals from both populations mature as females at age four; most of those at Catalina function as females for 4 yr and then change sex, at a length of around 310 mm. Sexual transformation occurs earlier on the average at Guadalupe; most individuals are male by age seven. In both populations, more rapidly growing fishes apparently change sex sooner than other individuals of the same age, and fishes that grow slowly may not change sex at all. Spawning appears to occur in July, August, and September in the Catalina population. Individuals probably spawn several times in a breeding season. The weight of active, prespawning ovaries increases at a rate approximately proportional to the third power of the length of the fish. Ovary weight increases in a linear fashion with age in the Catalina population. The rate of increase with age would be less in the Guadalupe population due to dwarfing.

75-000114 CONTINUED
The three coloration phases of /P. pulchrum/ are described, two of which are found in adult individuals. The uniform coloration is made up mostly of mature female and immature fishes. About 5 percent of the mature uniform individuals were males at Catalina, and about 12 percent at Guadalupe. The bicolored phase is made up exclusively of males and late transitional individuals. Data from field transects revealed that there were about five uniform individuals to every biocolored male. Based on an estimated yearly survival rate of about 0.7, the mature sex ratio at Catalina was approximately two females for every male. The ratio of Guadalupe was closer to three females for every two males, due in part to the earlier sex changes seen there.

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

75-000115 Bustard, D. R.; Narver, D. W. (B. C. Fish Wildl. Br., Smithers, BC, Can.) ASPECTS OF THE WINTER ECOLOGY OF JUVENILE COHO SALMON (/ONCORHYNCHUS KISUTCH/) AND STEELHEAD TROUT (/SALMO GAIRDNERI/). J. Fish. Res. Board Can. 32 (5): 667-680. May 1975. In English with French summ. SFA 20(3).
The major physical characteristics of overwintering areas for juvenile coho salmon (/Oncorhynchus kisutch/) and steelhead trout (/Salmo gairdneri/) are described for a small, unlogged, west coast Vancouver Island stream. During the winter months age I+ coho and steelhead were found at a range of depths mainly greater than 45 cm and in deeper water than age 0 of either species. About 45 percent of age 0 steelhead observed were in water less than 15 cm deep. The depth occupied by coho and age I+ steelhead was negatively correlated with water temperature below 8.5 C. Coho were associated less closely with the bottom than were steelhead. At 7 C or less most fish were associated with water velocities of less than 15 cm/s. Velocities in which steelhead occurred were positively correlated with rising temperature above 4 C. As water temperature decreased from 9 to 2 C, coho and steelhead moved closer to cover. Cover used by coho and age I+ steelhead most frequently was logs and upturned tree roots, although debris accumulations and overhanging banks were also used. Both age-groups of coho used overhanging brush but steelhead did not. Over 50 percent of age 0 steelhead were associated with rocks 10-25 cm in diameter. Sidepools and quiet back channels that contained water only in the winter and that had combinations of the above cover types were populated by coho during the winter. A series of unused beaver ponds, dry in the summer, was an important overwintering area for coho with a survival rate about twice as high as the 35 percent estimated for the entire stream system.

75-000116 Campbell, K. P.; Klauda, R. J.; McKenzie, D. (Texas Instruments Inc., P.O., Box 237, Buchanan, NY 10511) MOVEMENT OF STRIPED BASS TAGGED IN THE HUDSON RIVER. Presented at the Atl. Estuarine Res. Soc. Meeting, Annapolis, Md. 13p. 1-3 May 1975. SFA 20(3).
From 1 April 1972 through 30 June 1974, 891 striped bass ranging in total length from less than 100 mm to greater than 1000 mm were tagged and released in the Hudson River. Twenty-three tags were returned through 31 December 1974 (2.6 per cent) from fish which ranged in length at release from 120 - 1040 mm; 21 were greater than 500 mm. Fourteen returns came from outside the Hudson and its tributaries: in southwestern Long Island Sound, off the southwestern end of Long Island and as far north as Boston Harbor, Massachusetts. Distance traveled was correlatd with fish length (r = 0.943, p less than 0.001),

75-000117 Fritz, E. S.; Lotrich, V. A. (Dep. Biol. Sci., Univ. Del., Newark 19711) FALL AND WINTER MOVEMENTS AND ACTIVITY LEVEL OF THE MUMMICHOG, /FUNDULUS HETEROCLITUS/, IN THE TIDAL CREEK. Chesapeake Sci. 16 (3): 211-215. Sept. 1975. SFA 20(3).

Fall and winter movements and activity levels of /Fundulus heteroclitus/, the mummichog, were monitored in a Delaware tidal creek from September, 1973 to January, 1974. Fish either moved upstream into less saline waters or remained on station. As photoperiod decreased, high.

75-000118 Howe, A. B.; Coates, P. G. (Dep. Nat. Resour., Div. Mar. Fish., Sandwich, MA 02563) WINTER FLOUNDER MOVEMENTS, GROWTH, AND MORTALITY OFF MASSACHUSETTS. Trans. Am. Fish. Soc. 104 (1): 13-29. Jan. 1975. SFA 20(3).

From 1960 to 1965, 12,151 winter flounder (/Pseudopleuronectes americanus/) were tagged with Petersen tags at 21 locations off Massachusetts. Returns through 1971 totaled 4,440 or 36.5 percent. Ratio of females to males at tagging was 2.3. Movements north of Cape Cod were relatively localized and confined to inshore waters, whereas south of Cape Cod, flounder seasonally dispersed in a southeastward direction generally beyond the territorial limit; movements appeared to be related to water temperature. Little mixing occurred between Georges Bank and inshore areas. Growth of fish north of Cape Cod, south and east of Cape Cod, and on Georges Bank was described by "Walford lines" developed from tagging data. In 1964 apparent rates of exploitation, natural mortality, and annual total mortality were 0.201, 0.273, and 0.474, respectively, for fish released in Vineyard and Nantucket Sounds.

75-000119 Kelso, J. R. M.; Minns, C. K. (Dep. Environ., Can. Center Inland Waters, Burlington, Ont. L7R 4A6, Can.) SUMMER DISTRIBUTION OF THE NEARSHORE FISH COMMUNITY NEAR A THERMAL GENERATING STATION AS DETERMINED BY ACOUSTIC CENSUS. J. Fish. Res. Board Can. 32 (8): 1409-1418. Aug. 1975. In English with French summ. SFA 20(3).

The relation between thermal plumes and fish abundance and distribution was studied at the Pickering Nuclear Generating Station, Lake Ontario, using simultaneous digital echo counting and temperature monitoring systems during summer thermal stratification of the lake.

Fish relative abundance varied from 20.8/10,000 m toc 1,037/10,000 cu m and both these extreme density estimates occurred in the 7.5-12.5-m depth shell. Also, changes in distribution of the nearshore community where apparent during the study period, July-October. The fish community in July was pelagic and selected 10-11 C and 14-16 C. that same community later appeared to become segregated into benthic and pelagic communities. Thermal plumes, either well defined or diffuse, appeared to have little effect on the pelagic community either because fish were not available to elevated temperatures by habitat selection or because fish failed to respond to increased surface temperatures.

75-000120 McCleave, J. D.; Fried, S. M. (Dep. Zool., Univ. Me., Orono 04473) NIGHTTIME CATCHES OF FISHES IN A TIDAL COVE IN MONTSWEAG BAY NEAR WISCASSET, MAINE. Trans. Am. Fish. Soc. 104 (1): 30-34. Jan. 1975. SFA 20(3).

Summer nighttime abundance and localized distribution of fishes in a tidal cove were studied by beach seining for comparison with a previous daytime study. American eels were relatively abundant at night and absent during the day. Alewife, blueback herring, and Atlantic silverside were more abundant in the cove at night. Although mummichog numbers were greatly reduced at night, they remained an important constituent of the night fauna. Lesser components of the night fauna included Atlantic herring, Atlantic tomcod, smooth flounder, winter flounder, and rainbow smelt.

FOODS AND FEEDING

75-000121 Bass, R. J.; Avault, J. W., Jr. (U.S. Army Corps Eng., P.O. Box 1229, Galveston, TX 77550) FOOD HABITS, LENGTH-WEIGHT RELATIONSHIP, CONDITION FACTOR, AND GROWTH OF JUVENILE RED DRUM, /SCIAENOPS OCELLATA/, IN LOUISIANA. Trans. Am. Fish. Soc. 104 (1): 35-45. Jan. 1975. SFA 20(3).

Food habits of 568 juvenile red drum, /Sciaenops ocellata/ (Linnaeus), ranging from 8.0 to 183.0 mm standard length, were determined during the time the fish utilized a Louisiana salt marsh as a nursery area. Potentially available food organisms were sampled during the 7-mo study. Some degree of selectivity by juvelile red drum was demonstrated, but generally the most abundant organisms of an edible size were utilized most heavily. Changes in food with increasing size can be described in three phases: 1) red drum less than 15 mm ate zooplankton; 2) between 15 mm and 75 mm the red drum ate mostly small bottom invertebrates and the young of other fish; 3) red drum larger than 75 mm ate decapods (crabs and shrimp) and fish. Some differences between day and night feeding were found. For red drum 65 to 85 mm the dominant food eaten was grass shrimp during the day, whereas at night it was fish. The length-weight relationship was log W = 7.2052 + (4.1913) (log L). The average coefficient of condition was 1.969. Average growth per month ranged between 13.8 and 25.6 mm during the study period.

75-000122 Burns, D. C. (Dep. Fish. Resour., Univ. Idaho, Moscow 83843) FEEDING BY MATURE STEELHEAD (/SALMO GAIRDNERII GAIRDNERII/) IN THE SPAWNING STREAM. Calif. Fish Game 60 (4): 205-207. Oct. 1974. SFA 20(3).

75-000123 Feller, R. J.; Kaczynski, V. W. (Dep. Oceanogr., Univ. Wash., Seattle 98195) SIZE SELECTIVE PREDATION BY JUVENILE CHUM SALMON (/ONCORHYNCHUS KETA/) ON EPIBENTHIC PREY IN PUGET SOUND. J. Fish. Res. Board Can. 32 (8): 1419-1429. Aug. 1975. In English with French summ. SFA 20(3).

Analysis of gut contents shows that juvenile (30-50 mm) chum salmon (/Oncorhynchus keta/) in Puget Sound select epibenthic organisms as their primary prey. Harpacticoid copepods numerically comprised over 80 percent of their natural diet in two areas studied, while terrestrial insects and cladocerans were most important in a third area. Calculation of Ivlev (1961) electivity coefficients indicated high selectivity factors for harpacticoids at one site (+0.59 to +0.94). Comparison of fish gut contents with quantitative epibenthic pump samples of available prey shows that prey selection was size

75-000123 CONTINUED
related, but opposite that currently reported in the literature (e.g. Brooks and Dodson 1965); that is, the smaller of the available prey was preferred. This was true for both the total available prey size spectrum and the harpacticcid copepod fraction of the prey spectrum. Large numbers of prey eaten per fish suggest that juvenile chum salmon may exert high predation pressure on nearshore epibenthic organisms in Puget Sound during spring.

75-000124 Hickey, C. R., Jr. FISH BEHAVIOR AS REVEALED THROUGH STOMACH CONTENT ANALYSIS. N.Y. Fish Game J. 22 (2): 148-155. July 1975. SFA 20(3).
Analysis of stomach contents of fishes not only reveals what prey organisms are taken, but it also reveals many aspects of the ecology and habits of the predator such as vertical and horizontal movements, day/night activity, competition between species and degree of adaptability to changes in food abundance and types. Such studies may also be useful in describing the biotic environment in which the fish live, e.g., the seasonal, temporal and spacial abundance of prey organisms. Energy-flow through an ecosystem can be visualized by understanding the type of feeders present and their trophic levels. To illustrate the use of fish stomach analysis in understanding fish behavior data are given for the windowpane flounder (/Scophthalmus aquosus/) in Long Island (N.Y.) waters.

75-000125 Jeffries, H. P. (Grad. Sch. Oceanogr., Univ. Rhode Island, Kingston 02881) DIETS OF JUVENILE ATLANTIC MENHADEN /BREVCORTIA TYRANNUS/ IN THREE ESTUARINE HABITATS AS DETERMINED FROM FATTY ACID COMPOSITION OF GUT CONTENTS. J. Fish. Res. Board Can. 32 (5): 587-592. May 1975. In English with French summ. SFA 20(3).
Juvenile Atlantic menhaden /Brevoortia tyrannus/ feed on zooplankton and particulate organic matter, but the importance of each material in the diet cannot be visually determined, because food is ground to an amorphous paste in the fish's gizzard-like stomach. During early digestion in the anterior alimentary canal, fatty acids do not appear to change significantly, at least with respect to relative concentrations of saturated and unsaturated groups. Because zooplankton and particulate organic matter have markedly different fatty acid compositions, a hypothetical mixture of the two components can be calculated that best accounts for the observed fatty acid distributions of gut contents. Decreasing reliance on zooplankton, from bay through river to marsh, probably reflects resource abundances in three habitats and demonstrates adaptability of juvenile menhaden to different food supplies.

75-000126 Lange, G. D.; Hurley, A. C. (Hurley, A. C.: Dep. Neurosci., Scripps Inst. Oceanogr., La Jolla, CA 92037) A THEORETICAL TREATMENT OF UNSTRUCTURED FOOD WEBS. NOAA Fish. Bull. 73 (2): 378-381. Apr. 1975. SFA 20(3).
In a recent paper, Issacs had proposed a model for an unstructured food web in which the interconnections are so diverse that all heterotrophs in the system can be treated as if they were at the same average trophic position. This paper recasts the original model in terms of a 3 x 3 matrix using three empirical constants. In this form, the model can be easily generalized to one having nine constants and reflecting a more realistic view of the interactions among levels of a community.

75-000127 Lasker, R. (Southwest Fish. Cent., NMFS, La Jolla, CA 92037). FIELD CRITERIA FOR SURVIVAL OF ANCHOVY LARVAE: THE RELATION BETWEEN INSHORE CHLOROPHYLL MAXIMUM LAYERS AND SUCCESSFUL FIRST FEEDING NOAA Fish. Bull. 73 (3): 453-462. July 1975. SFA 20(3).

Northern anchovy larvae, /Engraulis mordax/, produced by laboratory-spawned fish, have been used to detect concentrations of larval fish food in situ along the California coast. First-feeding larval anchovies, whose development was controlled by temperature manipulation aboard ship, were placed in samples of Los Angeles Bight water taken from the surface and from chlorophyll maximum layers. Feeding by larvae in water from the surface was minimal in all experiments but extensive feeding occurred in water from the chlorophyll maximum layers when these contained phytoplankters having minimum diameters of approximately 40 um and which occurred in densities of 20 to 40 particles/ml. In March and April 1974, the chlorophyll maximum layer along the California coast from Malibu to San Onofre (a distance of about 100 km) consisted chiefly of a bloom of the naked dinoflagellate /Gymnodinium splendens/, a food organism known to support growth in anchovy larvae. Copepod nauplii and nonliving particles were never in high enough concentration or of the proper size to be eaten by the larvae. A storm which caused extensive mixing of the top 20 m of water obliterated the chlorophyll maximum layer and effectively destroyed this feeding ground of the larval anchovy.

75-000128 Lett, P. F.; Beamish, F. W. H.; Farmer, G. J. (Dep. Environ., Biol. Sta., St. Andrews, NB E0G 2X0 Can.) SYSTEM SIMULATION OF THE PREDATORY ACTIVITIES OF SEA LAMPREYS (/PETROMYZON MARINUS/) ON LAKE TROUT (/SALVELINUS NAMAYCUSH/). J. Fish. Res. Board Can. 32 (5): 623-631. May 1975. In English with French summ. SFA 20(3).

A stochastic dynamic model was developed to evaluate the simulated and empirical interactions between sea lampreys (/Petromyzon marinus/) and two lake trout (/Salvelinus namaycush/) population structures, one without and the other with previous lamprey predation.

An arithmetic increase in lampreys induced a geometric decline in trout, which was dependent on the number of age-classes and the mean weight of trout. Large trout, when present, were subject to most of the lamprey predation allowing survival of smaller trout. Lethality increased exponentially with lamprey size resulting in peak lake trout mortality during fall near the end of the lamprey's feeding period. Lake trout scarring data could be used only as an index of lamprey abundance when trout:lamprey ratios and trout population structures were known. The simulation suggested that sea lampreys and lake trout could coexist if large trout are not removed by commercial fishing and if some exogenous factor controlled lamprey abundance.

75-000129 Lewis, G. E. (W.Va. Dep. Nat. Resour., Romney 26757) NOTES OF DIGESTION OF THE BROOK SILVERSIDE BY LARGEMOUTH BASS. Prog. Fish-Cult. 37 (2): 92. Apr. 1975. SFA 20(3).

75-000130 Moore, C. J.; Fuller, S. L. H.; Burton, D. T. (Acad. Nat. Sci. Philadelphia, Benedict Estuarine Res.Lab., Benedict, MD 20612) A COMPARISON OF FOOD HABITS OF WHITE PERCH (/MORONE AMERICANA/) IN THE HEATED EFFLUENT CANAL OF A STEAM ELECTRIC STATION AND IN AN ADJACENT RIVER SYSTEM. Environ. Lett. 8 (4): 315-323. 1975. SFA 20(3).

Analysis of the stomach contents of 97 white perch, /Morone americana/, taken from the effluent canal of a steam electric station (S.E.S.) and 106 white perch from adjacent Patuxent River waters indicated similar food habits from September 1970 through August 1971. However, 35 percent of all white perch taken from the heated effluent

75-000130 CONTINUED
canal contained small pieces of coal and cinders, whereas only 3 percent of the river specimens contained such items in their stomachs. Fly ash and coal dust are present on the bottom of the S.E.S. canal whereas little such material, if any, can be found on the river bottom in the study area. This suggests the canal fish were actively feeding in the heated effluent and not simply moving into the canal after feeding in the river. No significant difference (P greater than 0.05) was found between the average wet weight stomach contents of the river and canal fish within the same month.

75-000131 Orth, R. J. (Dep. Zool., Univ. Md., College Park 20742) DESTRUCTION OF EELGRASS, /ZOSTERA MARINA/, BY THE COWNOSE RAY, /RHINOPTERA BONASUS/, IN THE CHESAPEAKE BAY. Chesapeake Sci. 16 (3): 205-208. Sept. 1975. SFA 20(3).
Destruction of /Zostera/ beds in the York River, Virginia, is attributed to the digging activities of the cownose ray, /Rhinoptera bonasus/. The physically stable /Zostera/ habitat with high faunal diversity and density was replaced by an unstable sand habitat with low faunal diversity and density.

75-000132 Russo, R. A. (East Bay Reg. Park Dist., Oakland, CA 94619) OBSERVATIONS ON THE FOOD HABITS OF LEOPARD SHARKS (/TRIAKIS SEMIFASCIATA/) AND BROWN SMOOTHHOUNDS (/MUSTELUS HENLEI/). Calif. Fish Game 61 (2): 95-103. Apr. 1975. SFA 20(3).
Information on the food habits of the brown smoothhound (/Mustelus henlei/) and leopard shark (/Triakis semifasciata/) was collected from May, 1970 through June, 1973. The stomach contents of 45 leopard sharks and 25 smoothhounds from San Francisco Bay, California revealed similar food habits as are found in Tomales Bay, California.
Of the smoothhounds examined, 39 percent contained shrimp, 35 percent crabs, and 22 percent fish. Of the leopard sharks examined, 17 percent contained shrimp, 16 percent crabs, and 19 percent fish. The occurrence of a significant quantity of shore crabs (/Hemigrapsus oregonensis/) in smoothhounds indicates a definite intertidal feeding habit, which is not evidenced by the quality of food in leopard sharks. In addition, 17 percent of the leopard sharks contained fish eggs, 9 percent clam necks, and 19 percent contained worms. While shrimp, crabs and fish were important items in the diets of both sharks, leopards are distinguished by the appearance of clam necks, worms, and fish eggs in significant quantities. The occurrence of benthic forms like /Upogebia/, /Callianasa/ and /Urechis/ and various clam necks indicates a shoveling or burrowing habit by leopard sharks in capturing prey. This idea is supported by findings on concentrations of chlorinated hydrocarbons in leopard and brown smoothhound liver tissues.

75-000133 Stickney, R. R.; Taylor, G. L.; White, D. B. (Skidway Inst. Oceanogr., P.O. Box 13687, Savannah, GA 31408) FOOD HABITS OF FIVE SPECIES OF YOUNG SOUTHEASTERN UNITED STATES ESTUARINE SCIAENIDAE. Chesapeake Sci. 16 (2): 104-114. June 1975. SFA 20(3).
The food habits of five species of the family Sciaenidae, /Bairdiella chrysura, Cynoscion regalis, Leiostomus xanthurus, Micropogon undulatus/ and /Stellifer lanceolatus/, were examined in specimens of less than 200 mm standard length collected in estuaries between Georgetown, South Carolina, and Jacksonville, Florida. /B. chrysura, M. undulatus/ and /S. lanceolatus/ did not appear to be highly selective in their food habits; /C. regalis/ fed heavily on the mysid shrimp, /Neomysis americana/, and on fish; and /L. xanthurus/ was selective toward harpacticoid and calanoid copepods. The food habits of the five species of fish examined were relatively constant

75-000133 CONTINUED
with season and location within the estuary; however, in general, larger food organisms were consumed as the sciaenids increased in size. The exception was /L. xanthurus/ which maintained the same food habits at all sizes examined.

75-000134 Wurtsbaugh, W. A.; Brocksen, R. W.; Goldman, C. R. (Clear Lake Algal Res. Unit., 1825 S. Main St., Lakeport, CA 95453) FOOD AND DISTRIBUTION OF UNDERYEARLING BROOK AND RAINBOW TROUT IN CASTLE LAKE, CALIFORNIA. Trans. Am. Fish. Soc. 104 (1): 88-95. Jan. 1975. SFA 20(3).

A difference was found in the summer distribution of underyearling brook trout, /Salvelinus fontinalis/ (Mitchill), and planted rainbow trout, /Salmo gairdneri/ Richardson, in Castle Lake, California. Brook trout underyearlings oriented to the bottom and were found primarily in shallow water on the eastern shore of the lake near springs. The rainbow trout underyearlings were more pelagic and were found in the littoral areas along the entire shoreline.

Gravimetrically, the food eaten during the summer by brook trout underyearlings was 13 percent terrestrial, 11 percent limnetic, and 76 percent benthic. Rainbow trout ate 15 percent terrestrial, 15 percent limnetic, and 70 percent benthic food.

In summer, rainbow trout adults are located in the epilimnion in Castle Lake, whereas adult brook trout are found near the bottom of the lake beyond the littoral zone. Due to this spatial isolation, their diets differ considerably. An earlier study showed that during the summer, adult brook trout ate 20 percent terrestrial, 31 percent limnetic, and 49 percent benthic food (by volume). Adult rainbow trout ate 49 percent terrestrial, 33 percent limnetic, and 18 percent benthic food.

AGE AND GROWTH

75-000135 Dark, T. A. (Northwest Fish. Cent., NMFS, 2725 Montlake Blvd. E., Seattle, WA 98112). AGE AND GROWTH OF PACIFIC HAKE, /MERLUCCIUS PRODUCTUS/. NOAA Fish. Bull. 73 (2): 336-355. Apr. 1975. SFA 20(3).

The age and growth of Pacific hake, /Merluccius productus/, collected off California, Oregon, and Washington in 1964-69, were studied.

The age determination prccedure was examined and considered to provide valid ages.

Several sources of variation in the age structure of the population were given cursory examination. Relative size of the year class and sampling area (average age tends to increase with latitude) contribute substantially to the variation of the population age composition while sex and sampling season have lesser effects.

Growth in length is rapid during the first 3 yr after which it slows and approaches an asymptote in the oldest ages, 10-13 yr. Females have a faster rate of growth than males and tend to survive 2 or 3 yr longer, to age 13. Growth in length can be adequately described by the von Bertalanffy growth equations: l(t) = 56.29 (1-e to the -0.39(t-0.20)) for males and l(t) = 61.23 (1-e to the -0.30(t-0.01)) for females. Year class variation in growth rate was detected by back-calculation, using the body length (/Y/)-otolith radius (/X/) relationship /Y/ = 18.78957-3.79065/X/ + 0.67490/X/ squared - 0.01836/X/ cubed. Growth in weight was determined by use of the length-weight equations: log /W/ = -1.45990 + 2.55618 log /L/ for males and log /W/ = -1.68944 + 2.69509 log /L/ for females. Males attain an average weight of about 1,211 g by age 11 and females reach

75-000135 CONTINUED
an average weight of 1,374 g by age 13. Annual instantaneous growth rates in weight were computed and were found to decrease most during the fourth year for both sexes and very little growth occurred after the sixth year for males or after the ninth year for females.

75-000136 Falk, M. R.; Gillman, D. V. (Dep. Environ., Fish. Manage. Div., Winnipeg, Man., Can.) DATA ON THE LAKE AND ROUND WHITEFISH, LAKE CISCO, NORTHERN PIKE, ARCTIC GRAYLING AND LONGNOSE SUCKER FROM THE EAST ARM OF GREAT SLAVE LAKE, N. W. T., 1971-74. Dep. Environ., Fish. Mar. Serv. Fish. Oper. Dir. Cent. Reg., Data Rep. Ser. No. CEN/D-75-2. viii + 95p. 1975. SFA 20(3).
From 1971 to 1974 a creel census and sampling program was carried out in the East Arm of Great Slave Lake to determine the harvest of lake trout (/Salvelinus namaycush/) by sport fishing lodges.

75-000137 Hauser, W. J. (1004 E. Holton Rd., El Centro, CA 92243) AN UNUSUALLY FAST GROWTH RATE FOR /TILAPIA ZILLII/. Calif. Fish Game 61 (1): 54-56. Jan. 1975. SFA 20(3).

75-000138 Heidinger, R. C. (Dep. Zool., South. Ill. Univ., Carbondale 62901) GROWTH OF HYBRID SUNFISHES AND CHANNEL CATFISH AT LOW TEMPERATURES. Trans. Am. Fish. Soc. 104 (2): 333-334. Apr. 1975. SFA 20(3)
The growth of hybrid sunfish (male bluegill, /Lepomis macrochirus X female green sunfish, /L. cyanellus/) and channel catfish (Ictalurus punctatus/) below 15 C was determined in ponds on natural food and in cages on artificial feed. In all cases, the hybrids gained weight, while the channel catfish lost weight.

75-000139 Hickey, C. R., Jr.; Amish, R. A. (N.Y. Ocean Sci. Lab., Montauk 11954) STUNTED GROWTH OF A JAWLESS STRIPED BASS, /MORONE SAXATILIS/. Trans. Am. Fish. Soc. 104 (2): 410-412. Apr. 1975. SFA 20(3).
During a one-year marine ichthyofaunal study of Northport, New York, only one abnormal fish was taken, a striped bass, /Morone saxatilis/. This 3-year-old fish, lacking a lower jaw and part of the upper, was apparently injured between its second and third year of life, as evidenced by much reduced scale formation during that period. The fish, measuring 260 mm standard length and weighing 291.1 grams, was much smaller than normal fish of comparable age, being nearer the size of 2-year-old fish. This stunted growth was presumably due to reduced feeding ability resulting from the injury.

75-000140 Matlock, G. C.; Marcello, R. A., Jr.; Strawn, K. (Oreg. State Univ. Mar. Sci. Cent., Newport 97365) STANDARD LENGTH-TOTAL LENGTH RELATIONSHIPS OF GULF MENHADEN, /BREVOORTIA PATRONUS/ GOODE, BAY ANCHOVY, /ANCHOA MITCHILLI/ (VALENCIENNES), AND ATLANTIC CROAKER, /MICROPOGON UNDULATUS/ (LINNAEUS), FROM GALVESTON BAY. Trans. Am. Fish. Soc. 104 (2): 408-409. Apr. 1975. SFA 20(3).
Regression equations were developed between standard length (SL) and total length (TL) for /Brevoortia patronus/, /Anchoa mitchilli/, and /Micropogon undulatus/ taken from Galveston Bay, Texas. The standard length-total length conversion equation for /B. partonus/ was TL = 0.68044 + 1.25323 SL, and for /A. mitchilli/ it was TL = 0.22391 + 1.20634 SL. The conversion equations for /M. undulatus/ changed with body length: TL = 1.21592 + 1.26753 SL (for fish 28-95 mm SL:) TL =

75-000140 CONTINUED
9.70548 + 1.17538 SL (for fish 102-159 mm SL); and TL = 19.88505 + 1.10952 SL (For fish 168-255 mm SL).

75-000141 Rybock, J. T.; Horton, H. F.; Fessler, J. L. (Dep. Fish. Wildl., Oregon State Univ., Corvallis 97331) USE OF OTHLITHS TO SEPARATE JUVENILE STEELHEAD TROUT FROM JUVENILE RAINBOW TROUT. NOAA Fish. Bull. 73 (3): 654-659. July 1975. SFA 20(3).

Otolith nuclei were investigated as a means of separating juvenile steelhead trout, /Salmo gairdneri/, from juvenile rainbow trout, /S. gairdneri/, in the lower Deschutes River, Oreg. An intensive recreational fishery necessitiated development of a technique for differentiation so that impact of the fishery on each race could be assessed independently.

Investigations of adults and hatchery-reared young of /S. gairdneri/ revealed that otolith nuclei of steelhead are significantly larger than those of rainbow, size of otolith nuclei does not change with growth of either race, and there are no differences in size of otolith nuclei due to sex or origin (wild vs. hatchery). Thus, size of otolith nuclei provides a means to differentiate effectively juvenile steelhead trout and juvenile rainbow trout regardless of sex or origin. Results also indicated that steelhead mature at a larger size than rainbow, egg size is directly related to body size of dam in both races, and size of otolith nuclei is likely determined by egg size.

75-000142 Spratt, J. D. (Calif. Dep. Fish Game, Sacramento 95814) GROWTH RATE OF THE NORTHERN ANCHOVY, /ENGRAULIS MORDAX/, IN SOUTHERN CALIFORNIA WATERS, CALCULATED FROM OTOLITHS. Calif. Fish Game 61 (3) : 116-126. July 1975. SFA 20(3).

The annual growth rate for northern anchovies in southern California waters was determined by measuring annuli formed in otcliths and then back calculating to length at time of annuli formation. The calculated mean lengths at end of each year of life were 92, 112, 124, 135, 145, and 155 mm (3.6, 4.4, 4.9, 5.3, 5.7, and 6.1 inches) SL for ages 1 through 6 respectively. A growth curve fitted by the von Bertalanffy growth equation yielded lengths of 92, 111, 125, 135, 143, and 149 mm (3.6, 4.4, 4.9, 5.3, 5.6, and 5.9 inches) SL for ages 1 through 6 respectively.

75-000143 Yong, M. Y. Y.; Skillman, R. A. (Southwest Fish Cent. Honolulu Lab., NMFS, Honolulu, HI 96812) A COMPUTER PROGRAM FOR ANALYSIS OF POLYMODAL FREQUENCY DISTRBUTIONS (ENORMSEP), FORTRAN IV. NOAA Fish. Bull. 73 (3): 681. July 1975. SFA 20(3).

Program ENORMSEP (Extended Normal Separator Program) separates a polymodal frequency distribution into its component groups where aging studies have not been or cannot be performed. The program calculates preliminary estimates of the number of size groups and their points of overlap using probit analysis and polynomial regression techniques. A description of the program, including program listing as well as input and output for two examples, is available from the authors upon request. (RS)

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

75-000144 Allison, D.; Hothem, H. (Ohio Div. Wildl. 952 Lima Ave., Findlay 45840) AN EVALUATION OF THE STATUS OF THE FISHERIES AND THE STATUS OF OTHER SELECTED WILD ANIMALS IN THE MAUMEE RIVER BASIN, OHIO. Ohio Div. Wildl., mimeo 16p. June 1975. SFA 20(3).

75-000145 Anderson, M. E.; Cailliet, G. M. (Moss Landing Mar. Lab., Moss Landing, CA 95039) OCCURRENCE OF THE RARE NORTH PACIFIC FROSTFISH, /BENTHODESMUS ELONGATUS PACIFICUS/ PARIN AND BECKER, 1970, IN MONTEREY BAY, CALIFORNIA. Calif. Fish Game 61 (3): 149-152. July 1975. SFA 20(3).

75-000146 Andreasen, J. K. (Dep. Fish. and Wildl., Oreg. State Univ., Corvallis 97331) OCCURRENCE OF THE FATHEAD MINNOW, /PIMEPHALES PROMELAS/, IN OREGON. Calif. Fish Game 61 (3): 155-156. July 1975. SFA 20(3).

75-000147 Bass, A. J.; D'Aubrey J. D.; Kistnasamy, N. SHARKS OF THE EAST COAST OF SOUTHERN AFRICA. II. THE FAMILIES /SCYLIORHINIDAE/ AND /PSEUDOTRIAKIDAE/. S. Afr. Assoc. Mar. Biol. Res., Invest. Rep. No. 37. 64p. Apr. 1975. Available from The Librarian, Oceanogr. Res. Inst., P.O. Box 736, Durban 4000, South Africa. SFA 20(3).

75-000148 Bass, A. J.; D'Aubrey, J. D.; Kistnasamy, N. SHARKS OF THE EAST COAST OF SOUTHERN AFRICA. III. THE FAMILIES CARCHARHINIDAE (EXCLUDING /MUSTELUS/ AND /CARCHARHINUS/) AND SPHYRNIDAE. S. Afr. Assoc. Mar. Biol. Res., Invest. Rep. No. 38. 100p. June 1975. Available from The Librarian, Oceanog. Res. Inst., P.O. Box 736, Durban 4000, South Africa. SFA 20(3).

75-000149 Bass, A. J.; D'Aubrey J. D.; Kistnasamy, N. SHARKS OF THE EAST COAST OF SOUTHERN AFRICA. IV. THE FAMILIES ODONTASPIDIDAE, SCAPANORHYNCHIDAE, ISURIDAE, CETORHINIDAE, ALOPIIDAE, CRECTOLOBIDAE AND RHINIODONTIDAE. S. Afr. Assoc. Mar. Biol. Res., Invest. Rep. No. 39. 102p. Sept. 1975. Available from The Librarian, Oceanog. Res. Inst., P.O. Box 736, Durban 4000, South Africa. SFA 20(3).

75-000150 Blackburn, M.; Willams, F. (Scripps Inst. Oceanogr., P.O. Box 1529, La Jolla, CA 92037) DISTRIBUTION AND ECOLOGY OF SKIPJACK TUNA, /KATSUWONUS PELAMIS/, IN AN OFFSHORE AREA OF THE EASTERN TROPICAL PACIFIC OCEAN NOAA Fish. Bull. 73 (2): 382-411. Apr. 1975. SFA 20(3).

Distribution of skipjack tuna, /Katsuwonus pelamis/, were studied in the offshore eastern tropical Pacific between lat. 15 degrees N and 5 degrees S, long. 115 degrees and 125 degrees W, during two cruises in 1970 and 1971. Another cruise was made there with different methods in 1969. All cruises were between October and April. Various environmental properties were measured.

Catches of skipjack included fish smaller and larger than those generally taken near the American coast. This is consistent with previous hypotheses that mature adults and their larvae generally occur far offshore, whereas adolescents are generally coastal, in the eastern Pacific. The juveniles arriving near the coast and the older fish leaving it evidently cross the studied area on migrations from

75-000150 CONTINUED
and to the spawning regions.
In 1970 and 1971 skipjack greater than 45 cm were most abundant in the equatorial upwelling and at the northern boundary of the North Equatorial Countercurrent, and scarce in the Countercurrent. Correlation coefficients between skipjack greater than 45 cm and skipjack forage in 1970 were positive and significant by the usual criteria, but the significance may in part by disputable because many other correlations involving skipjack were nonsignificant. The apparent significance was lost when juvenile skipjack (less than 45 cm) were included with the larger ones. Juveniles may have different relations to environment. The 1971 data were scanty and yielded no significant correlations between skipjack and forage.
On the 1969 cruise forage was not studied. Skipjack were abundant in the Countercurrent, but at a prespawning stage, whereas postspawners predominated on the other cruises. Other studies suggest that skipjack larvae require relatively high temperatures, which occurred only in the Countercurrent on the 1969 cruise. Skipjack may be distributed according to the environmental requirements of their larvae when spawning and according to their own feeding requirements when not spawning.

75-000151 Cailliet, G. M.; Anderson, M. E. (Moss Landing Mar. Lab., Moss Landing, CA 95039) OCCURRENCE OF THE PROWFISH /ZAPRORA SILENUS/ JORDAN, 1896 IN MONTEREY BAY, CALIFORNIA. Calif. Fish Game 61 (1): 60-62. Jan. 1975. SFA 20(3).

75-000152 de Wit, L. A. (Dames and Moore, 1100 Glendon Ave., Los Angeles, CA 90024) CHANGES IN THE SPECIES COMPOSITION OF SHARKS IN SOUTH SAN FRANCISCO BAY. Calif. Fish Game 61 (2): 106-111. Apr. 1975. SFA 20(3).

75-000153 Fahay, M. P. (Middle Atl. Coast. Fish. Cent., NMFS, Highlands, NJ 07732) AN ANNOTATED LIST OF LARVAL AND JUVENILE FISHES CAPTURED WITH SURFACE-TOWED METER NET IN THE SOUTH ATLANTIC BIGHT DURING FOUR RV /DOLPHIN/ CRUISES BETWEEN MAY 1967 AND FEBRUARY 1968. NOAA Tech. Rep. NMFS SSRF-685. iv + 39p. Mar. 1975. SFA 20(3).

75-000154 French, R. R.; Bakkala, R. G.; Sutherland, D. F. (Northwest Fish. Cent. NMFS, 2725 Montlake Blvd. E., Seattle, WA 98112) OCEAN DISTRIBUTION OF STOCKS OF PACIFIC SALMON, /ONCORHYNCHUS/ SPP., AND STEELHEAD TROUT, /SALMO GAIRDNERII/, AS SHOWN BY TAGGING EXPERIMENTS. CHARTS OF TAG RECOVERIES BY CANADA, JAPAN, AND THE UNITED STATES, 1956-69. NOAA Tech. Rep. NMFS SSRF-689. viii + 89p. June 1975. SFA 20(3).
Extensive tagging experiments by member nations of the International North Pacific Fishing Commission- Canada, Japan, and the United States-have been conducted in offshore waters of the North Pacific Ocean to investigate the ocean distribution of stocks of Pacific salmon, /Oncorhynchus/ spp. This effort has resulted in the recovery of 15,215 tags including steelhead trout, /Salmo gairdnerii/, from inshore and high-seas areas. To provide a reference by which the offshore distribution of the various stocks can be readily seen as shown by tagging results through 1969, the tagging locations at sea are illustrated for each species and recovery area.

75-000155 Green, R. E. (NMFS, Tiburon Fish. Lab., Tiburon, CA 94920) A PRELIMINARY LIST OF FISHES COLLECTED FROM RICHARDSON BAY, CALIFORNIA 1972-1973. Calif. Fish Game 61 (2): 104-106. Apr. 975. SFA 20(3).

75-000156 Hambrick, P. S.; Hocutt, C. H.; Masnik, M. T.; Wilson, J. H. (Dep. Biol., VPI & SU Blacksburg, VA 24061) ADDITICNS TO THE WEST VIRGINIA ICHTHYOFAUNA, WITH COMMENTS ON THE DISTRIBUTION OF OTHER SPECIES. Proc. W.Va. Acad. Sci. 45 (1): 58-60. 1973. SFA 20(3).
Fishes collected from the East River, West Virginia, during 1972 are reported upon. The collections resulted in the addition of two new species, /Notropis galacturus/ and /Notropis telescopus/, to the known West Virginia ichthyofauna. New distributional records for /Exoglossum maxillingua/, /Nocomis l. leptocephalus/, /Notropis cornutus chrysocephalus/, /Notropis hudsonius/, and /Percina crassa roanoka/ are noted. One species, /Etheostoma caeruleum/, was added to the fauna of the New (upper Kanawha) River drainage. It is recommended that /Nocomis l. leptocephalus/, Notropis galacturus/, /Notropis telescopus/, and /Percina crassa roanoka/ be placed on the West Virginia list of rare and endangered fishes.

75-000157 Hartmann, A. R.; Clarke, T. A. (P. O. Box 422, Bodega Bay, CA 94923) THE DISTRIBUTION OF MYCTOPHID FISHES ACROSS THE CENTRAL EQUATORIAL PACIFIC. NOAA Fish. Bull. 73 (3): 633-641. July 1975. SFA 20(3).
Analysis of myctophic fishes collected in the upper 50-75 m at night along long. 145 degrees W between lat. 12 degrees N and 3 degrees 30 min S indicated three faunal groups. Warmwater species occurred across the entire transect and were most abundant at or just north of the equator. A second group of species occurred only in the North Equatorial Current or the Counter Current, but most are known to be more widely distributed. A third group occurred only at or just north of the equator; all are apparently found within a small latitudinal range between about long. 130 degrees and 170 degrees W. Certain species which are abundant in the central water mass were absent from the present samples. The faunal change within the equatorial water mass is likely a response to the increased primary production and food supply resulting from upwelling near the equator and northward transport of enriched surface waters. Some of the faunal changes observed appear to be replacements of one species by a congener or morphologically similar species.

75-000158 Hauser, W. J. (Univ. Calif.-Riverside, Imperial Valley Field Sta., 1004 E. Holton Rd., El Centro, CA 92243). OCCURRENCE OF TWO CONGRIDAE LEPTOCEPHALI IN AN ESTUARY. NOAA Fish. Bull. 73 (2): 444-445. Apr. 1975. SFA 20(3).
Two leptocephali of /Conger oceanicus/ were collected from an estuary on the northern coast of Maine. They have never before been reported being collected in such low-salinity waters. (RS)

75-000159 Hickey, C. R., Jr.; Lester, J. W. NOTES ON LUMPFISH FROM MONTAUK, NEW YORK. N.Y. Fish Game J. 22 (2): 164-166. July 1975. SFA 20(3).

75-000160 Hobson, E. S. (NMFS, Tiburon Fish. Lab, Tiburon, CA 94920) FIRST CALIFORNIA RECORD OF THE SERRANID FISH /ANTHIAS GORDENSIS/ WADE. Calif. Fish Game 61 (2): 111-112. Apr. 1975. SFA 20(3).

75-000161 Hocutt, C. H.; Stauffer, J. R. (Environ. Res. Tech. Inc., Concord, MA 01742). INFLUENCE OF GRADIENT ON THE DISTRIBUTION OF FISHES IN CONOWINGO CREEK, MARYLAND AND PENNSYLVANIA. Chesapeake Sci. 14 (2): 143-147. June 1975. SFA 20(3).

Twenty-seven fish species were collected from Conowingo Creek at eleven stations during the summer, 1970. Species most abundant were /Rhinichthys atratulus, Notropis cornutus, Exoglossum maxillingua, Semothilus atromaculatus/ and /Catostomus commersoni/. A Spearman's rank correlation coefficient matrix was calculated for biological and physical parameters. Distribution of fishes appeared related to width and depth of the stream, but was most influenced by gradient.

75-000162 Holden, P. B.; Stalnaker, C. B. (Utah Coop. Fish. Unit, Logan) DISTRIBUTION AND ABUNDANCE OF MAINSTREAM FISHES OF THE MIDDLE AND UPPER COLORADO RIVER BASINS, 1967-1973. Trans. Am. Fish. Soc. 104 (2): 217-231. Apr. 1975. SFA 20(3).

Twenty-nine species of fishes were collected in the middle and upper Colorado River basins in 1967-1973. The native suckers, /Catostomus latipinnis/ and /C. discobolus/, were the dominant species in the study area. Introduced species outnumbered native species 19 to 10. The introduced /Ictalurus punctatus/ and /Notropis lutrensis/ were abundant throughout most of the upper basin. The abundance of introduced species has increased steadily since 1900 as has the introductions of new species. Four endemic species, /Ptychocheilus lucius/, /Gila elegans/, /Gila cypha/, and /Xyrauchen texanus/, are considered endangered. These rare forms reproduce in the lower Yampa River, Desolation Canyon of middle Green River, and the lower Green River in Canyonlands National Park. The major reasons for the decline of native fishes are considered to be alterations of habitat by high dams and introductions of exotic species.

75-000163 Jenkins, R. E.; Burkhead, N. M. (Dep. Biol., Roanoke Coll., Salem, VA 24153) DISTRIBUTION AND ASPECTS OF LIFE HISTORY AND MORPHOLOGY OF THE CYPRINID FISH /NOTROPIS SEMPERASPER/ ENDEMIC TO THE UPPER JAMES RIVER DRAINAGE, VIRGINIA. Chesapeake Sci. 16 (3): 178-191. Sept. 1975. SFA 20(3).

The roughhead shiner, /Notropis semperasper/, is known only from nine streams of the upper James River drainage in the Ridge and Valley physiographic province of Virginia. It typically inhabits warm, usually clear, medium to wide sections of these streams where there is moderate gradient and hard bottom with little siltation. Slow to moderate currents of pools and backwaters are preferred. It was proposed for inclusion on lists of threatened species; new data shift it to borderline status, not clearly warranting continuation on such lists. It should, however, be monitored because of environmental modifications completed, under construction, and proposed for occupied streams.

The largest specimen examined, 72.8 mm SL, was in its fourth or fifth year of life. The sexes appear to grow at about equal rates. Spawning probably begins in May and extends into June but not later than late August. /N. semperasper/ is unique in that young individuals develop "nuptial" tubercles. Juvenile males and females bear cephalic and body tubercles but only adult males possess well developed pectoral fin tubercles. Tubercles, although long persistent after spawning in many specimens, exhibit a pattern of loss and reproliferation.

75-000163 CONTINUED
Means for identifying the species are noted. Data from previously unstudied populations suggests an absence of significant intraspecific variation.

75-000164 Kendall, A. W., Jr.; Reintjes, J. W. (Middle Atl. Coastal Fish. Cent., Sandy Hook Lab., Highlands, NJ 07732) GEOGRAPHIC AND HYDROGRAPHIC DISTRIBUTION OF ATLANTIC MENHADEN EGGS AND LARVAE ALONG THE MIDDLE ATLANTIC COAST FROM RV /DOLPHIN/ CRUISES, 1965-66. NOAA Fish Bull. 73 (2): 317-335. Apr. 1975. SFA 20(3).
Atlantic menhaden, /Brevoortia tyrannus/, eggs and larvae were collected during eight ichthyoplankton cruises of the RV /Dolphin/ from December 1955 to December 1966. On each cruise tows were made with a Gulf V plankton net at 92 stations along 14 transects from the coast to the edge of the continental shelf from Martha's Vineyard, Mass., to Cape Lookout, N.C. Larvae resulting from a protracted spawning season were taken throughout the year. Eggs were taken over the middle of the shelf in fall. Seasonal shifts in geographic pattern of larvae indicated spawning started in summer off New Jersey and New York, became widespread in the Middle Atlantic Bight in fall, and continued into winter off North Carolina. Larvae were equally distributed in shallow (0-15 m) and in deep (18-33 m) tows during night and day. Larvae occurred over a water temperature range from 0 to 25 C and a salinity range of 29 to 36°/oo. Seasonal distribution of larvae suggests some of the annual variation in year classes may be due to cold-related mortality of larvae entering middle Atlantic estuaries in late fall.

75-000165 Knaggs, E. H.; Sunada, J. S.; Lea, R. N. (Calif. Dep. Fish Game, 350 Golden Shore, Long Beach 90802) NOTES ON SOME FISHES COLLECTED OFF THE OUTER COAST OF BAJA CALIFORNIA. Calif. Fish Game 61 (1): 56-59. Jan. 1975. SFA 20(3).

75-000166 Love, M. S.; Lee, R. S. (Dep. Biol., Univ. Calif., Santa Barbara 93017) NEW GEOGRAPHIC AND BATHYMETRIC RECORDS FOR FISHES FROM SOUTHERN CALIFORNIA. Calif. Fish Game 60 (4): 212-216. Oct. 1974. SFA 20(3).

75-000167 Love, M. S.; Vucci, J. (Dep. Biol., Univ. Calif., Santa Barbara 93017) RANGE EXTENSION OF THE CHINA ROCKFISH. Calif. Fish Game 60 (3): 149. July 1974. SFA 20(3).

75-000168 Markle, D. F. (Va. Inst. Mar. Sci., Gloucester Pt. 23062) YOUNG WITCH FLOUNDER, /GLYPTOCEPHALUS CYNOGLOSSUS/, ON THE SLOPE OFF VIRGINIA. J. Fish. Res. Board Can. 32 (8): 1447-1450. Aug. 1975. In English with French summ. SFA 20(3).
Young witch flounder, /Glyptocephalus cynoglossus/, 11-25 cm TL, are abundant on the continental slope off Virginia. The Virginian slope may be a major nursery area for 1- to 3- or4-yr-old witch flounder spawned by one or more northern stocks. Shelf water circulation patterns are considered as a possible mechanism for the passive dispersal of larvae.

75-000169 Moyle, P. B.; Fisher, F. W.; Li, H. W. (Div. Wildl. Fish., Univ. Calif., Davis 95616) MISSISSIPPI SILVERSIDES AND LOGPERCH IN THE SACRAMENTO-SAN JOAQUIN RIVER SYSTEM. Calif. Fish Game 60 (3): 144-147. July 1974. SFA 20(3).

75-000170 Quirollo, L. F.; Dinnel, P. A. (Calif. Dep. Fish Game, Eureka 95501) LATITUDINAL RANGE EXTENSIONS FOR YELLOW AND SPOTTED SNAKE EELS (GENUS /OPHICHTHUS/). Calif. Fish Game 61 (3): 156-157. July 1975. SFA 20(3).

75-000171 Rahman, A. K. A. (Freshwater Fish. Res. Sta., Chandpur, Comilla, Bangladesh) A CHECKLIST OF THE FRESHWATER FISHES OF BANGLADESH PART II.--CLUPEIFORMES (= ISOSPONDYLI). Bangladesh J. Sci. Ind. Res. 9 (3 & 4): 207-211. July-Oct. 1974. SFA 20(3).
Clupeoid fishes from Bangladesh are listed. The list includes 6 families, 21 genera and 43 species two of which are yet to be identified. The habitat of the members of the group and their availability in freshwater areas in Bangladesh are discussed. Known vernacular names have been included in the list.

75-000172 Rahman, A. K. A. (Freshwater Fish. Res. Sta., Chandpur, Comilla, Bangladesh) A CHECKLIST OF THE FRESHWATER FISHES OF BANGLADESH PART I.--CYPRINIFORMES (= OSTARIOPHYSI). Bangladesh J. Sci. Ind. Res. 9 (3 & 4): 198-206. July-Oct. 1974. SFA 20(3).
A checklist of the fishes of the order Cypriniformes inhabiting the freshwater areas in Bangladesh is provided. The list included 14 families, 51 genera and 125 species. A species of the genus /Osteochilus/ Gunther from Sylhet is the first record of the genus in Bangladesh. Zoological names in the list have been revised in accordance with the law of priority. Known vernacular names have been shown in the list.

75-000173 Richardson, S. L.; Joseph, E. B. (Oreg. St. Univ., Corvallis 97331) OCCURRENCE OF LARVAE OF THE GREEN GOBY, /MICROGOBIUS THALASSINUS/, IN THE YORK RIVER, VIRGINIA. Chesapeake Sci. 16 (3): 215-219. Sept. 1975. SFA 20(3).
Five hundred fifty-four larvae of /Microgobius thalassinus/ were collected from June through October 1966 in the York River 0 to 46 km from the mouth. /M. thalassinus/ larvae were distinguished by having a double row of more than seven evenly spaced melanophores along the ventral body margin. Larval distribution in the York River was restricted to salinities of 16.69 to 23.25°/oo, compared with larvae of /Gobiosoma bosci/ which occurred in fresher water and larvae of /G. ginsburgi/ which are associated with more saline waters.

75-000174 Richardson, S. L.; DeHart, D. A. (Sch. Oceanogr., Oregon State Univ., Corvallis 97331) RECORDS OF LARVAL, TRANSFORMING, AND ADULT SPECIMENS OF THE QUILLFISH, /PTILICHTHYS GOODEI/, FROM WATERS OFF OREGON. NOAA Fish. Bull. 73 (3): 681-685. July 1975. SFA 20(3).
This report extends the southern range of the quillfish, /Ptilichthys goodei/ Bean 1881, in the northeast Pacific to waters off the central coast of Oregon where larval, transforming, and adult specimens have been collected. The previously reported range of this species in the North Pacific was from the Okhotsk and Bering seas to northern Washington and Puget Sound. (From Auth. Intro.)

75-000175 Rogers, D. W. (Calif. Dep. Fish Game, Sacramento) CHUM SALMON OBSERVATIONS IN FOUR NORTH COAST STREAMS. Calif. Fish Game 60 (3): 148. July 1974. SFA 20(3).

75-000176 Smith, W. G.; Sibunka, J. D.; Wells, A. (Wells, A.: Middle Atl. Coastal Fish. Cent., Sandy Hook Lab., Highlands, NJ 07732) SEASONAL DISTRIBUTIONS OF LARVAL FLATFISHES (PLEURONECTIFORMES) ON THE CONTINENTAL SHELF BETWEEN CAPE COD, MASSACHUSETTS, AND CAPE LOOKOUT, NORTH CAROLINA, 1965-66. NOAA Tech. Rep. NMFS SSRF-691. iv + 68p. June 1975. SFA 20(3).

Larval flatfishes, representing 4 families, 17 genera, and 15 species, were identified from collections taken during a 1-yr survey designed to locate spawning grounds and trace dispersion of fish eggs and larvae on the continental shelf. Most flatfishes begain spawning in the spring, a time of marked seasonal temperature change. The seasonal distribution of larvae indicated that: 1) bothids had longer spawning seasons than pleuronectids; 2) pleuronectids spawned largely in the northern half of the survey area during the spring; 3) most bothids spawned in the southern half, beginning in spring and continuing through early fall; 4) although cynoglossids spawned incidentally off North Carclina, most of their larvae were transported into the survey area from spawning grounds south of Cape Lcokout; 5) the few representatives of the family Soleidae originated south of Cape Lookout; 6) spawning that began in the spring prcceeded from south to north as the season progressed, but spawning that began in the fall proceeded from north to south, suggesting that the onset of spawning is triggered by spring warming and fall cooling; 7) most species spawned within a relatively narrow range of temperature; 8) salinity had no apparent influence on spawning.

75-000177 Sparks, R. E.; Starrett, W. C. (Ill. Nat. Hist. Surv., Urbana 61801) AN ELECTROFISHING SURVEY OF THE ILLINOIS RIVER, 1959-1974. Ill. Nat. Hist. Surv. Bull. 31 (8): 317-380. Aug. 1975. SFA 20(3).

Because of their importance as unique resources, the Illinois River and its bottomland lakes were studied intensively by the Illinois State Laboratory of Natural History and its successor, the Natural History Survey, from 1874 to 1927 (Forbes 1928:387). Mcre recently, surveys of the fish populations of the river have been conducted regularly from the 1940's to the present. Various types of sampling gear have been employed in these surveys, for various purposes. For example, minnow seines were used regularly in mid-summer to collect small fish and thereby gauge the spawning success of species which spawn in the spring. Hoop nets were used to collect large fish in backwaters and bottomland lakes. The present report concerns primarily the electrofishing surveys, which have been conducted regularly in the Illinois River in the fall, from 1959 through 1974. (From Auth. Intro.)

75-000178 Tarter, D. C. (Dep. Biol. Sci., Marshall Univ., Huntington, WV 25701) A PRE-IMPOUNDMENT INVESTIGATION OF THE LIMNOLOGY OF EAST FORK OF TWELVEPOLE CREEK, LINCOLN, MINGO, AND WAYNE COUNTIES, WEST VIRGINIA. Proc. W.Va. Acad. Sci. 44 (1): 94-103. 1972. SFA 20(3).

The fish populations at 10 collecting stations in Twelvepole Creek were sampled by rotenone, in order to determine the species composition prior to impoundment. Seven families represented by 38 species of fish were collected during the study. A total of 1,474 fish which weighed about 64 pounds were collected above the dam site. Game fishes comprised 25.4 per cent of the total number of fishes and 33.6

75-000178 CONTINUED
per cent of the total weight; rough fishes, 14.1 per cent by number and 36.1 per cent by weight; and forage fishes 60.5 per cent by number and 30.3 per cent by weight. Maximum and minimum standing crops were 221.3 and 16.6 pounds per acre, respectively; the average was 87.97 pounds per acre.

The benthic invertebrates at the 10 collecting stations were sampled with a bottom dredge. A total of 707 organisms were collected which represented 9 orders, 24 families, and about 36 species. The following benthic taxa were ranked according to percentage frequency by number; Ephemeroptera (42.7), Diptera (13.8), Decapoda (13.8), Trichoptera (10.6), Odonata (7.4), Coleoptera (6.7), Plecoptera (2.3), Mollusca (1.6), and Megaloptera (1.1).

The following physical and chemical parameters were determined: dissolved oxygen, mean = 8.8 (7.1-11.0) mg/l; pH, mean = 6.6 (6.3-7.0) ; total hardness, mean = 32.0 (20.0-75.0) mg/l CaCO(3); total alkalinity, mean = 32.0 (15.0-60.0) mg/l CaCO(3): iron, mean = 0.9 (0.2-2.0) mg/l; sulfate, mean = 12.0 (7.0-16.0) mg/l; and temperature, mean = 21.6 (17.0-28.0) C.

75-000179 Wintersteen, J. (Mar. Biol. Consult., Inc., 947 Newhall St., Costa Mesa, CA 92627) OCCURRENCE AND DEPTH RANGE EXTENSION OF THE YELLOW SNAKE EEL (/OPHICHTHUS ZOPHOCHIR/) OFF SOUTHERN CALIFORNIA. Calif. Fish Game 61 (3): 157-158. July 1975. SFA 20(3).

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY

75-000180 Galat, D. L.; Eipper, A. W. (Colo. Coop. Fish. Unit, Colo. Stat Univ., Ft. Collins 80523) PRESENCE OF FOOD ORGANISMS IN THE PROLARVAL ENVIRONMENT AS A FACTOR IN THE GROWTH AND MORTALITY OF LARVAL MUSKELLUNGE (/ESOX MASQUINONGY/). Trans. Am. Fish. Soc. 104 (2): 338-341. Apr. 1975. SFA 20(3).

Three different feeding programs were used to assess the need for zooplankton in the environment of prolarval muskellunge. These were: (1) no zooplankton available to the larvae (filtered water) until 80 percent of them had become free-swimming, with pond zooplankton introduced daily thereafter, (2) pond zooplankton introduced daily after hatching was 90 percent complete, and (3) /Artemia/ nauplii (under 4 days old) introduced 3 times daily beginning with 90 percent hatch.

Neither mortalities nor dry weights differed significantly between treatments, indicating that presence of food organisms prior to swim-up was not critical to survival or growth of muskellunge larvae under the conditions of this experiment. /Artemia/ appear to be a satisfactory hatchery diet for larval muskellunge during their first 3 weeks of life.

75-000181 Hoopes, R. L. (Benner Spring Fish Res. Sta., Bellefonte, PA 16823) FLOODING AS THE RESULT OF HURRICANE AGNES, AND ITS EFFECT ON A NATIVE BROOK TROUT POPULATION IN AN INFERTILE HEADWATER STREAM IN CENTRAL PENNSYLVANIA. Trans. Am. Fish. Soc. 104 (1): 96-99. Jan. 1975. SFA 20(3).

A 22.7 m s discharge, which is at least 150 times normal summer discharge, reduced the population of marked young-of-the-year trout by 96 percent in the 49-day interim between the June 1972 preflood and August 1972 postflood samples. Other year classes decreased, but less dramatically. Mortality for young-of-the-year between August 1972 and October 1972 was negligible. The standing crop of trout was reduced from 26.4 kg/hectare in June to 21.9 kg/hectare in August. Of the

75-000181 CONTINUED
surviving trout, 28.3 percent moved out of the section in which they were marked. No fish was recovered more than 1,220 m from the section in which it was marked.

75-000182 Jensen, A. L. (Sch. Nat. Resour., Univ. Mich. Ann Arbor 48104). COMPUTER SIMULATION OF EFFECTS ON ATLANTIC MENHADEN YIELD OF CHANGES IN GROWTH, MORTALITY, AND REPRODUCTION. Chesapeake Sci. 16 (2): 139-142. June 1975. SFA 20(3).

A self-regenerating dynamic pool model fitted to the Atlantic menhaden population was applied to simulate yield as a function of the parameters for growth, reproduction, and mortality. A random variable was applied to simulate random environmental fluctuations. For each combination of parameters the yield for 50 replicates of 50 generations was calculated. Under normal conditions considerable fluctuation in yield from the menhaden population can be expected. Decrease in the growth parameter produced the largest decrease in yield and an increase in adult mortality produced the smallest decrease in yield. The combined effects of simultaneous changes in more than one parameter were approximatily additive.

75-000183 Miller, L. W. (Calif. Dep. Fish Game, Sacramento) MORTALITY RATES FOR CALIFORNIA STRIPED BASS (/MORONE SAXATILIS/) FROM 1965-1971. Calif. Fish Game 60 (4): 157-171. Oct. 1974. SFA 20(3).

Harvest rates on striped bass (/Morone saxatilis/) in the Sacramento-San Joaquin Estuary varied between 12 and 19 percent for the years 1965 to 1971. The mean harvest rate since 1965 (0.151) is 40 percent lower than the mean of 0.253 for the years 1958-64. Survival rates for 1965-71 varied from 61 to 69 percent. The mean survival rate (0.654) for this period was 21.3 percent higher than the 1958-64 mean of 0.539.

A decline in angler success and angler effort appears related to a declining population. Exploitation rates have declined and survival rates increased apparently in response to lower fishing pressure.

The bass tagged in 1965-66 averaged larger than bass tagged in previous years. Return rates were higher for females than for males.

75-000184 Neves, R. J. (Mass. Coop. Fish. Unit., Univ. Mass., Amherst 01002) FACTORS AFFECTING FRY PRODUCTION OF SMALLMOUTH BASS (/MICROPTERUS DOLOMIEUI/) IN SOUTH BRANCH LAKE, MAINE. Trans. Am. Fish. Soc. 104 (1): 83-87. Jan. 1975. SFA 20(3).

The early life history of the smallmouth bass was studied for two summers (1971-1972) in South Branch Lake, Penobscot County, Maine, to determine what factors were affecting fry production. The spawning behavior of one male with two females is described. Nesting success for the two spawning seasons was 67 percent and 77 percent, respectively, with an average of 3,943 fry rising off each nest. Nest fanning by males did not measurably increase egg survival but did reduce mortality of sac-fry. Egg mortality was highest in the nests of smaller males (less than 400 mm) with large egg deposits. A water level drop was considered the primary cause for the lower nesting success in 1971.

75-000185 St. Pierre, R. A.; Hoagman, W. J. (Va. Inst. Mar. Sci., Gloucester Point 23062) DRASTIC REDUCTION OF THE WHITE PERCH, /MORONE AMERICANA/, POPULATION IN THE JAMES RIVER, VIRGINIA. Chesapeake Sci. 16 (3): 191-197. Sept. 1975. SFA 20(3).

The white perch population in the James River declined to near extinction by the summer of 1971. Only several individuals were captured after extensive trawling and beach seining in 1972 and 1973, whereas similar effort yielded thousands in previous years. The commercial catch simultanecusly dropped to an all time low. The cause of the population plummet apparently was a massive fish kill in May of 1971. The precise cause of the fish kill was not determined.

75-000186 Sylvester, J. R.; Nash, C. E. (Oceanic Inst., Makapuu Pt., Waimanalo, HI 96795) THERMAL TOLERANCE OF EGGS AND LARVAE OF HAWAIIAN STRIPED MULLET, /MUGIL CEPHALUS/ L. Trans. Am. Fish. Soc. 104 (1): 144-147. Jan. 1975. SFA 20(3).

Relationships between temperature and mortality of eggs and survival of the larvae are described for the striped mullet /Mugil cephalus/ L. Eggs were incubated at temperatures between 1.0 and 40.5 C. Mortalities were least (4.2 percent) within the range 22.7-23.3 C. Hatching time was inversely related to temperature. The equation Y = 3.6674 - 1.5240 X describes the relation between incubation time and temperature over the range of 11-30 C. Larvae were exposed to temperatures between 2.7 and 32.9 C. Survival up to 12 days was greatest (19.9 percent) at a mean temperature of 24.9 C (range 24.5-25.3 C).

IDENTIFICATION, KEYS, CLASSIFICATION

75-000187 Ban-Tuvia, A. (Dep. Zool., Hebrew Univ., Jerusalem, Israel) MUGILID FISHES OF THE RED SEA WITH A KEY TO THE MEDITERRANEAN AND RED SEA SPECIES) Bamidgeh 27 (1): 14-20. Mar. 1975. SFA 20(3).

The collection of the Hebrew University of Jerusalem contains a considerable number of Red Sea mugilids collected during the last thirty years from the Gulf of Aqaba, the Gulf of Suez, and the coast of Ethiopia. A total of seven species have been identified. /Crenimugil crenilabis/ (Forsskal), /Plicomugil labiosus/ (Valenciennes), /Liza carinata/ (Ehrenberg, in Cuv. Val.) and /Valimugil seheli/ (Forsskal) are common in coastal waters of the northern Red Sea. The Atlanto-Mediterranean /Liza aurata/ (Risso) has been found in several localities along the Asiatic coasts of the Gulf of Aqaba and the Gulf of Suez, being evidently common in this region. Its presence in the northern Red Sea could be explained by the proximity of the Suez Canal, which links the Red Sea with the Mediterranean Sea, or by earlier connections. Specimens of /Mugil cephalus/ have been observed in the fish market of Massawa, Ethiopia, one of which has been preserved. They have also been found in the Gulf of Aqaba, Israel. Two specimens of /Liza subviridis/ (Valenciennes) have also been collected from the coast of Ethiopia. It is interesting to note that /Liza carinata/ immigrated to the eastern Mediterranean, apparently via the Suez Canal, and occasionally occurs in the Bardawil Lagoon and in Haifa Bay. A key to the Mugilidae of the coasts of Israel has been prepared.

75-000188 Collette, B. B.; Chao, L. N. (Syst. Lab., NMFS, Natl. Mus. Nat. Hist., Washington, DC 20560) SYSTEMATICS AND MORPHOLOGY OF THE BONITOS (/SARDA/) AND THEIR RELATIVES (SCOMBRIDAE, SARDINI). NOAA Fish. Bull. 73 (3): 516-625. July 1975. SFA 20(3).

The bonitos constitute the scombrid tribe Sardini, consisting of eight species placed in five genera. They differ from the more primitive mackerels and Spanish mackerels in lacking a notch in the hypural plate and in having a bony lateral keel on the posterior caudal vertebrae. From the higher tunas, they differ in having the bony keel only incompletely developed and in lacking a specialized subcutaneous vascular system. The monotypic Australian endemic /Cybiosarda elegans/ shares several characters with the monotypic eastern Atlantic endemic /Orcynopsis unicolor/ (structure of the bony caudal keel; relative lengths of liver lobes; position and size of spleen) that distinguish them from /Gymnosarda unicolor/ and the species of /Sarda/. /Sarda/ contains four allopatric species, which differ from each other in such characters as numbers of fin rays, gill rakers, vertebrae, and teeth: the Atlantic /S. sarda/; the southeastern Australian /S. australis/; the tropical Indo-Pacific /S. orientalis/; and the eastern temperate Pacific /S. chiliensis/. The monotypic Indo-West Pacific reef species /Gymnosarda unicolor/ is the only member of the Sardini that has a swim bladder and lacks intermuscular bones on the back of the skull. The monotypic Southern Ocean /Allothunnus fallai/ differs from all other scombrids in having laterally extended prootic wings. It is more closely related to the bonitos than to any other scombrids. /Allothunnus/ resembles the higher tunas in having a prootic pit but lacks the subcutaneous vascular system. Tables of meristic characters, diagrams of the soft anatomy, and drawings of most bones are included in the first part of the paper. The second part of the paper includes sections on synonymy, comparative diagnosis, types of nominal species, and distribution for each species.

75-000189 Hubbs, C. L.; Miller, R. R. (Scripps Inst. Oceanogr., Univ. Calif., La Jolla 92037) /DIONDA ERIMYZONOPS/, A NEW, DWARF CYPRINID FISH INHABITING THE GULF COASTAL PLAIN OF MEXICO. Mus. Zool., Univ. Mich., Occas. Pap. No. 671. 17p. 10 July 1974. SFA 20(3).

Among the freshwater fishers of east-central Mexico, which comprise outlying elements of both Nearctic and Neotropical affinities, along with endemic elements (Osorio-Tafall, 1946; Alvarez, 1959; Darnell, 1962; Miller, 1966), the scuthernmost species referable to the cyprinid genus /Dionda/ (at least provisionally) have been perhaps the least well known. It is the purpose of this paper to describe a hitherto unnamed species which we name /Dionda erimyzonops/, because of its general resemblance to a young chub sucker (genus /Erimyzon/); it is one of four species that inhabit the Tamesi-Panucc river complex which discharges into the Gulf of Mexico at Tampico. It is roughly sympatric with the species we here call /Dionda ipni/ (Alvarez and Navarro), on the coastal-plain portion of the Tamesi-Panuco drainage system, but is allopatric with /Dionda rasconis/ (Jordan and Snyder), and another, yet unnamed species, that separarely inhabit higher and more western parts of this drainage basin. These three species have been placed in /Notropis/, but we provisionally refer them to /Dionda/. (From Auth. Intro.)

75-000190 Miller, R. R. (Mus. Zool., Univ. Mich., Ann Arbor 48104) FIVE NEW SPECIES OF MEXICAN POECILIID FISHES OF THE GENERA /POECILIA/, /GAMBUSIA/, AND /POECILIOPSIS/. Mus. Zool., Univ. Mich., Occas. Pap. No. 672. 44p. 29 Aug. 1975. SFA 20(3).

Five new species of poeciliid fishes of the genera /Poecilia/, /Gambusia/, and /Poeciliopsis/ are described from fresh waters on the Pacific and Atlantic coasts of Mexico. It is recommended that /Mollienesia/ be recognized as a valid subgenus. /Poecilia chica/, a small species with small fins and a jet-black breeding male, occurs inland in three small drainages in southern Jalisco. /Poecilia catemaconis/, a large, semipelagic lake species, with slender body, small dorsal and caudal fins, and numerous gill rakers, is restricted to Laguna Catemaco southeast of Veracruz City. It is recommended that use of species groups in /Gambusia/ be employed with caution until phyletic analyses are completed. /Gambusia eurystoma/, with a very broad mouth and the caudal fin boldly spotted in black, is described from a sulphur spring and outflow near Teapa, Tabasco. /Poeciliopsis turneri/, a boldly-marked species producing only a few large young at each birth, with uniserial jaw teeth and a placenta (developing embryos entirely dependent upon the mother), occurs in the same area as /Poecilia chica/ but is not quite as widespread. /Poeciliopsis catemaco/, restricted to the elevated lake of the same name, is a large, semipelagic species (females enter commercial catch) with numerous gill rakers and large young. All five species are illustrated. (Auth. Summ.)

75-000191 Miller, R. R. (Mus. Zool., Univ. Mich., Ann Arbor 48104) TWO NEW FISHES, /GILA BICOLOR SNYDERI/ AND /CATOSTOMUS FUMEIVENTRIS/, FROM THE OWENS RIVER BASIN, CALIFORNIA. Mus. Zool., Univ. Mich., Occas. Pap. No. 667. 19p. 2 Apr. 1973. SFA 20(3).

Many years ago Snyder (1917) described the isolated basin occupied by Owens River in eastern California and gave an account of its fishes. He recognized four species, three of which he believed to be identical with species in the Lahontan basin to the north, whereas the fourth was idedtified as /Cyprinodon macularius/ of the Colorado River basin to the southeast. Subsequently, the /Cyprinodon/ of Owens Valley was described as an endemic species, /C. radiosus/ (Miller, 1948: 87-99); its near extinction and recovery were recently treated by Miller and Pister (1971). For some time it has been known that two other kinds on Owens Valley fishes, a minnow and a sucker, are also restricted to the basin. The faunal relationships of the fourth species, /Rhinichthys osculus/, remain to be determined.

High endemism of the fauna is correlated with its isolation from that of surrounding drainage systems (Miller, 1948: 18-20; Hubbs and Miller, 1948: 77-78). The zoogeographical implications of the Owens River fauna have been treated by Miller (1946) and are discussed further here. The interconnected pluvial lakes of the area have been mapped and discussed most recently by Morrison (1965). (From Auth. Intro.)

75-000192 Rosenblatt, R. H.; Johnson, G. D. (Scripps Inst. Oceanogr., La Jolla, CA 92037) TWO NEW SPECIES OF SEA BASSES OF THE GENUS /DIPLECTRUM/, WITH A KEY TO THE PACIFIC SPECIES. Calif. Fish Game 60 (4): 178-191. Oct. 1974. SFA 20(3).

There are eight known species of the serranid genus /Diplectrum/ in the eastern Pacific: /D. conceptione/, /D. euryplectrum/, /D. macropoma/, /D. maximum/, /D. pacificum/, /D. sciurus/, and /D. eumelum/ n. sp. and /D. labarum/ n. sp. The species may be distinguished on the basis of numbers of fin rays, scales and gill-rakers, body shapes, length of fin spines, and shape of spine cluster. A key is given, and meristic data are presented. The range of /D.

75-000192 CONTINUED
maximum/ is extended north from Peru to Baja California, and the distinctively colored juveniles are described for the first time.

PARASITES AND DISEASES-GENERAL

75-000193 Cloutman, D. G. (Duke Power Co., Rt. 3, Box 90, Huntersville, NC 28078) PARASITE COMMUNITY STRUCTURE OF LARGEMOUTH BASS, WARMOUTH, AND BLUEGILL IN LAKE FORT SMITH, ARKANSAS. Trans. Am. Fish. Soc. 104 (2): 277-283. Apr. 1975. SFA 20(3).

Fish parasite community structure was studied on largemouth bass, warmouth, and bluegill from Lake Fort Smith, Arkansas during July 1970 throuth June 1971. Individual diversity did not fluctuate appreciably on a seasonal basis in any of the hosts. When individual diversity increased, redundancy tended to decrease, and vice versa. Community diversity displayed greater seasonal fluctuations than individual diversity, with highest values in late winter and early spring. There was no significant difference in parasite community structure between sexes of hosts. Community diversity tended to increase with age of hosts. Individual diversity increased with age of warmouth, but not of largemouth bass and bluegill. Negative correlations between /Posthodiplostomum minimum/ metacercaria and /Proteocephalus ambloplitis/ plerocercoids suggested possible antagonism between these two parasites.

75-000194 Hnath, J. G. (Mich. Dep. Nat. Resour., Wolf L. Fish Hatchery, Mattawan 49071) A SUMMARY OF THE FISH DISEASES AND TREATMENTS ADMINISTERED IN A COOL WATER DIET TESTING PROGRAM. Prog. Fish-Cult. 37 (2): 106-107. Apr. 1975. SFA 20(3).

75-000195 Lahav, M. (Lab. Res. Fish Diseases, Nir-Daviv, Israel) THE OCCURRENCE AND CONTROL OF PARASITES INFESTING MUGILIDAE IN FISH PONDS IN ISRAEL. Bamidgeh 26 (4): 99-103. Dec. 1974. SFA 20(3).

Two groups of parasites -- /Heterophyes/sp. and /Ergasilus/ -- presently cause damage to mullet in freshwater ponds. In mariculture, new problems may arise due to two copepods -- /Caligus/ sp. and /Pseudocaligus/ sp. Infestations of parasites have been found in mullet which must certainly influence their health as well as market quality. Several pesticides were used experimentally tc control /Ergasilus/. (RS)

BACTERIAL DISEASES

75-000196 Cook, D. W.; Lofton, S. R. (Gulf Coast Res. Lab., Ocean Springs, MS 39564) PATHOGENICITY STUDIES WITH A /STREPTOCOCCUS/ SP. ISOLATED FROM FISHES IN AN ALABAMA-FLORIDA FISH KILL. Trans. Am. Fish. Soc. 104 (2): 286-288. Apr. 1975. SFA 20(3).

A /Streptococcus/ sp. isolated from moribund fish in a 1972 Alabama-Florida fish kill produced mortalities in five species of fish involved in the kill. Pathogenicity studies with six non-fish-related streptococci were also conducted on two of the fishes.

75-000197 Roales, R. R.; Perlmutter, A. (Dep. Biol., N. Y. Univ., New York 10003) THE IMMUNE RESPONSE OF THE BLUE GOURAMI, /TRICHOGASTER TRICHOPTERUS/, TO /PROTEUS VULGARIS/. Trans. Am. Fish. Soc. 104 (2): 289-291. Apr. 1975. SFA 20(3).

Blue gourami do not appear to produce bacterial growth inhibiting antibodies against /Proteus vulgaris/. However, bacterial agglutinins are produced. The mean antibody titers produced at one and two weeks after the second antigen injection were 64-128 and 32, respectively.

75-000198 Shotts, E. B., Jr.; Bullock, G. L. (Dep. Med. Microbiol., Coll. Vet. Med., Univ. Ga., Athens 30602) BACTERIAL DISEASES OF FISHES: DIAGNOSTIC PROCEDURES FOR GRAM-NEGATIVE PATHOGENS. J. Fish. Res. Board Can. 32 (8): 1243-1247. Aug. 1975. In English with French summ. SFA 20(3).

A diagnostic scheme employing 10 media, 4 reagents, and 5 specific antiserums has been devised for identification of gram-negative pathogens of fishes. The scheme is not intended for detailed speciation of organisms, but for generic identification of organisms associated with infected fishes. Diagnosis can be accomplished in 24 h with selective media and antiserums, and in no more than 72 h with other media and reagents.

75-000199 Varga, S.; Hirtle, W. A. (Dep. Environ., Fish Insp. Lab., Halifax, NS B3J 2S7, Can.) INCIDENCE OF /VIBRIO PARAHAEMOLYTICUS/ IN FISH, SHELLFISH, MUD, WATER, AND FISH PRODUCTS IN THE CANADIAN MARITIME REGION. J. Fish. Res. Board Can. 32 (4): 541-544. Apr. 1975. In English with French summ. SFA 20(3).

A total of 853 samples taken in the Canadian Maritime Region during 1973 were examined for /Vibrio parahaemolyticus/. The incidence of organisms was only 1.41 percent in the samples examined. The organism was isolated during the summer and fall. Isolations were confined to samples taken in areas at the proximity of the shores.

PROTOZOAN DISEASES

75-000200 Bridges, D. W.; Pedro, D. R.; Laird, M. (P.O. Box 2320, South Portland, ME 04106) THE OCCURRENCE OF /HAEMOGREGARINA/ SP. IN THE GOOSEFISH (/LOPHIUS AMERICANUS/ VALENCIENNES) FROM THE GULF OF MAINE. Trans. Am. Fish. Soc. 104 (2): 284-285. Apr. 1975. SFA 20(3).

A blood smear from an immature goosefish (/Lophius americanus/ Valenciennes) revealed an intraerythrocyte haematozoan infestation. The parasite resembles /Haemogregarina platessae/ Lebailly, which has never been reported outside of the order Pleuronectiformes.

75-000201 Fitzgerald, P. R. (Coll. Vet. Med., Univ. Ill., Urbana 61801) NEW COCCIDIA FROM THE SPINY DOGFISH SHARK (/SQUALUS ACANTHIAS/) AND GREAT SCULPIN (/MYOXOCEPHALUS POLYACANTHOCEPHALUS/). J. Fish. Res. Board Can. 32 (5): 649-651. May 1975. In English with French summ. SFA 20(3).

New coccidia from the spiny dogfish shark, /Squalus acanthias/, and the great sculpin, /Myoxocephalus polyacanthocephalus/, from waters around the San Juan Islands, Puget Sound, Washington, are described and named. Thirty-one species of bony and two species of cartilaginous fishes were examined. Twenty-eight of 71 dogfish and one of four sculpins were infected with coccidia.

75-000202 Sawyer, T. K.; Hnath, J. G.; Conrad, J. F. (Middle Atlantic Coastal Fish. Cent., Oxford, MD 21654) /THECAMOEBA HOFFMANI/ SP. N. (AMCEBIDA: THECAMOEBIDAE) FROM GILLS OF FINGERLINE SALMONID FISH. J. Parasitol. 60 (4): 677-682. Aug. 1974. SFA 20(3).

A new species of aquatic ameba, /Thecamoeba hoffmani/ (Amoebida, Thecamoebidae), is described from the gills of fingerling rainbow trout, /Salmo gairdneri/, silver or coho salmon, /Oncorhynchus kisutch/, and chinook salmon, /O. tschawytscha/. The infestation is associated with brief periods of mortality believed to be caused in part by respiratory impairment due to the presence of amebae on gill lamellae of stressed fingerlings. Although amebae were found within necrotic gill tissues of one fish, it is concluded that /T. hoffmani/ is a free-living species. /T. hoffmani/ was found in hatchery-reared salmonids in Washington, Oregon, and Michigan.

75-000203 Sawyer, T. K.; Hoffman, G. L.; Hnath, J. G.; Conrad, J. F. (Hoffman, G. L.: U.S. FWS, Fish Farming Exp. Sta. Stuttgart, AR 72160) INFECTION OF SALMONID FISH GILLS BY AQUATIC AMEBAS (AMCEBIDA: THECAMOEBIDAE). IN W. E. Ribelin and G. Migaki, eds. The Pathology of Fishes, Univ. Wis. Press, Madison. 143-150. 1975. SFA 20(3).

/Thecamoeba/ sp. was found between the gill lamellae of moribund salmonids from Michigan, Washington, and Oregon. It is presumed that invasion by the amoeba is a secondary response to causes which support bacterial growth which favors reproduction of the otherwise free-living protozoa. (G. L. Hoffman)

VIRAL DISEASES

75-000204 Desautels, D.; MacKelvie, R. M. (Dep. Environ., Halifax Lab., Halifax, NS B3J 2R3, Can.) PRACTICAL ASPECTS OF SURVIVAL AND DESTRUCTION OF INFECTIOUS PANCREATIC NECROSIS VIRUS. J. Fish. Res. Board Can. 32 (4): 523-531. Apr. 1975. In English with French summ. SFA 20(3).

The survival of infectious pancreatic necrosis (IPN) virus under conditions of practical import and its susceptibility to destruction by two common disinfecting agents were examined. An indigenous strain of virus, shed to trough water at a concentration of 10^5 TCID-50 per milliliter during an epizootic, lost 99 percent of its infectivity in fresh water at 4 C in 10-12 wk. There was residual infectivity after 24 wk. Survival was prolonged in sea water where loss of activity of an ATCC strain after 10 wk incubation at either 4 or 10 C was negligible. The loss in 5-6 mo was under 99 percent.

IPN virus (10^5 TCID-50/ml) survived drying in air at laboratory temperature and humidity for 5 but not for 6 wk. Under reduced humidity, residual infectivity was still evident after 8 wk.

At a titer of 10^5 TCID-50/ml, IPN virus was completely inactivated by exposure to 25 ppm available chlorine in 30 min. A concentration of 40 ppm available chlorine was required to inactivate 10 to the 7.5th TCID-50 of virus/ml in the same period of time. IPN virus, at a titer of 10 to the 5.5th TCID-50/ml, was totally destroyed by 30 ppm active iodine (Wescodyne) in 5 min. An increase in virus concentration, to 10 to the 6.6th TCID-50/ml increased the iodine requirement to 35 ppm to achieve the same result.

The implications for salmonid culture of the persistence of IPN virus in an aqueous environment and its resistance to destructive agents are discussed.

75-000205 MacKelvie, R. M.; Desautels, D. (Dep. Environ., Halifax Lab., Halifax, N.S. B3J 2R3, Can.) FISH VIRUSES -- SURVIVAL AND INACTIVATION OF INFECTIOUS PANCREATIC NECROSIS VIRUS. J. Fish. Res. Board Can. 32 (8): 1267-1273. Aug. 1975. In English with French summ. SFA 20(3).

The survival of infectious pancreatic necrosis (IPN) virus under conditions pertaining to its retention in the laboratory, and its inactivation by several physical and chemical means were examined.

Approximately 99.9 percent of infectivity was lost when washed IPN virus (10 to the 6.5th-10^7 TCID(50)/ml), suspended in phosphate buffered saline (PBS) and Eagle's Minimal Essential Medium diluted 1:10 with PBS, was held at 4 C for 1 yr. After 2 yr more than 10^2 TCID(50)/ml remained in both suspensions. The virus survived equally well for 1 yr in 20 and 50 percent glycerol.

Thermal inactivation of IPN virus at 60 C proceeded in a two-component manner, each component following first-order kinetics. At neutral pH, the infectivity of 10^7 TCID(50)/ml was reduced by 99.9 percent in the first 30 min of exposure. After 5 h, 0.0001 percent still survived. Inactivation rate of the initial rapid component was increased by adjustment of pH to 3 and 10.

The curve for the 1:4000 formalin inactivation of 10 to the 6.5th TCID(50)/ml of IPN virus was multiphasic. When formalin-treated virus was titrated, cytopathic effect was delayed.

Under a UV intensity of 2000 uW/cm^2, the infectivity of 10^7 TCID(50)/ml of virus was lost exponentially during the first 6 min of exposure after which it abruptly leveled off. The curve was less steep and curvilinear under an intensity of 440 uW/cm^2. The level of tailing was the same in both cases.

IPN virus was predictably stable at pH 7 at 4 C. A surprising 0.001 percent of an original concentration of 10^7TCID(50)/ml survived incubation at pH 9 and 2 for 5 wk. The reported survival of IPN virus in homeothermic animals was related to its ability to withstand prolonged exposure to low pH and to its relative heat stability.

75-000206 Major, R. D.; McCraren, J. P.; Smith, C. E. (U.S. FWS, Hatchery Biologist Lab., Stuttgart, AR 72160) HISTOPATHOLOGICAL CHANGES IN CHANNEL CATFISH (/ICTALURUS PUNCTATUS/) EXPERIMENTALLY AND NATURALLY INFECTED WITH CHANNEL CATFISH VIRUS DISEASE. J. Fish. Res. Board. Can. 32 (4): 563-567. Apr. 1975. In English with French summ. SFA 20(3).

Two groups of fingerling channel catfish (/Ictalurus punctatus/), one experimentally infected with channel catfish virus disease by transmission through water, and the other collected during an active epizootic, were examined histologically. Previously unreported pathology of pancreatic and brain tissue is described. The virus elicits a histopathological response similar to that reported for the salmonid viruses.

75-000207 Nicholson, B. L.; Dexter, R. (Dep. Microbiol. Migratory Fish Res. Inst., Univ. Me., Orono 04473) POSSIBLE INTERFERENCE IN THE ISOLATION OF IPN VIRUS FROM CARRIER FISH. J. Fish. Res. Board Can. 32 (8): 1437-1439. Aug. 1975. In English with French summ. SFA 20(3).

This report describes an instance of possible homologous viral interference in the isolation of IPN virus from carrier fish. Brook trout (/Salvelinus fontinalis/), suspected of being carriers of IPN virus, were examined for the presence of the virus by inoculating monolayer cultures of RTG-2 cells with different dilutions of tissue homogenates of the suspected fish. Cultures of RTG-2 cells infected with concentrated tissue homogenates exhibited little, if any, cytopathic effect (CPE) and yielded little infectious IPN virus at 72 h after infection. However, cell cultures infected with a relatively

75-000207 CONTINUED
high dilution of tissue homogenate exhibited extensive CPE and resulted in high yields of infectious virus.

75-000208 Plumb, J. A.; Green, O. L.; Smitherman, R. O.; Pardue, G. B. (Ala. Agric. Exp. Sta., Auburn Univ., Auburn 36830) CHANNEL CATFISH VIRUS EXPERIMENTS WITH DIFFERENT STRAINS OF CHANNEL CATFISH. Trans. Am. Fish. Soc. 104 (1): 140-143. Jan. 1975. SFA 20(3).

Experimental infections of channel catfish virus were made by feeding virus to six strains of 1-, 2-, and 3-month-old channel catfish from different geographical areas and two hybrid strains. There was no significant difference in mortality between age groups. Mortality rates differed significantly between the various strains, with mean mortality ranging from 10 percent to 71 percent among infected fish. Mortality percentage of the Falcon group was significantly higher than all other groups. Hybrid strains had the lowest percentage of mortality.

75-000209 Rydlo, M. (Bundesinst. Gewasserford. Fischereiwirtsch., A 5341 Scharfling, Austria) QUANTITATIVE STUDIES ON THE SPORES OF /MYXOSOMA CEREBRALIS/ IN RAINBOW TROUT. Prog. Fish-Cult. 37 (1): 35 Jan. 1975. SFA 20(3).

75-000210 Yamamoto, T. (Dep. Microbiol., Univ. Alberta, Edmonton, A T6G 2E9, Can.) FREQUENCY OF DETECTION AND SURVIVAL OF INFECTIOUS PANCREATIC NECROSIS VIRUS IN A CARRIER POPULATION OF BROOK TROUT (/SALVELINUS FONTINALIS/) IN A LAKE. J. Fish. Res. Board Can. 32 (4 : 568-570. Apr. 1975. In English with French summ. SFA 20(3).

Brook trout (/Salvelinus fontinalis/) distributed from a hatchery into a small enclosed lake were examined for IPN virus carriers over period of 2 1/2 yr. The carrier rate of 90 percent at the time of distribution decreased to 69 percent, but organ analysis showed differing trends in carrier rate. There was a decrease of virus in th pancreas-caeca (82-32 percent) and an increase in the feces (2-39 percent) whereas virus was detected to be present at a constant level in the kidneys (53-57 percent) and the spleen (8-14 percent). Virus was not detected in the gonads except for a few which yielded virus later in the sampling period.

These data indicate that brook trout IPN carriers distributed from hatchery into lakes do not readily lose their virus over a period of several years, and that both caeca and kidneys are organs of choice for the detection of virus.

Neutralizing antibody levels were very low or nondetectable in the carrier population and could not be correlated with yield of virus.

OTHER DISEASES AND PARASITES

75-000211 Blahm, T. H.; McConnell, R. J.; Snyder, G. R. (Snyder, G. R.: Northwest Fish. Cent., NMFS, 2725 Montlake Blvd., Seattle, WA 98112) EFFECT OF GAS SUPERSATURATED COLUMBIA RIVER WATER ON THE SURVIVAL OF JUVENILE CHINOOK AND COHO SALMON. NOAA Tech. Rep. NMFS SSRF-688. 22p. Apr. 1975. SFA 20(3).

The deleterious effect of high concentrations of dissolved gas on valuable stocks of Columbia River salmon and trout has led pollution control agencies in the Pacific Northwest to consider establishing standards for the amount of dissolved gas in the water. Research has been done with salmonids to define the criteria upon which such standards should be based, but the majority of these studies were

75-000211 CONTINUED
carried out in shallow tanks (less than 1 m deep) where supersaturated concentrations of gas had been artifically induced. This report discusses tests that were performed at a field laboratory on the Columbia River. Juvenile chinook, /Oncorhynchus tshawytscha/, and coho, /O. kisutch/, salmon were tested in deep and shallow tanks with river water reflecting the prevailing (and fluctuating) concentrations of dissolved gasses. Results indicate that the water depth in a deep (3 m) test tank enhanced the survival of test fish compared to shallow tanks (less than 1 m). These tests support the hypothesis that test conditions in tanks 1 m deep are not representative of all river conditions that directly relate to mortality of juvenile salmon and trout in the Columbia River.

75-000212 Dansby, K. N.; Shoemaker, J. P. (108 Shawnee Pl., Lexington, KY 40506) A NEW SPECIES OF /OCTOMACRUM/ (TREMATODA: MONOGENEA) FROM THE STONEROLLER, /CAMPOSTOMA ANOMALUM/ (RAFINESQUE). Proc. W.Va. Acad. Sci. 45 (2): 93-96. 1973. SFA 20(3).

A new species of monogenetic trematode, /Octomacrum spinum/, was found on the gills of the Stoneroller, /Campostoma anomalum/, collected from Beech Fork, a tributary of Twelve Pole Creek, Wayne County, West Virginia. This is the fifth species in the genus, /Octomacrum/ Mueller, 1934. It shows the closest relationship to /O. europaeum/ Roman and Bychowsky, 1956, from which it differs in body shape and proportions, size, the presence of spines on the haptoral clamps, and the presence of setae and hooks on the body and haptor.

75-000213 Dell, M. B.; Erho, M. W.; Leman, B. D. (P.O. Box 878, Ephrata, WA 98823) OCCURRENCE OF GAS BUBBLE DISEASE SYMPTOMS ON FISH IN MID-COLUMBIA RIVER RESERVOIRS. Pub. Util. Dist. Grant, Douglas, Chelen Cty., Wash. 49p. Sept. 1975. SFA 20(3).

Over 30,000 anadromous and resident fish were examined for Gas Bubble Disease (GBD) symptoms in the mid-Columbia River region during the 1974 spill season (May-August). Types of gear employed to capture fish included Lake Merwin trap, beach seine, Pennsylvania trap and angling.

For the study period, only 3,221 fish out of 32,289 examined had GBD symptoms (10.0 percent). Game fish numbered 3,016 (mostly salmonids) and had 4.2 percent GBD symptoms. Resident fish (non-game) numbered 29,273 and had 10.6 percent GBD symptoms. Ranking of presence of GBD symptoms in fish from highest to lowest percentage by method of capture was as follows: for salmonids, Lake Merwin trap, beach seine, Pennsylvania trap; for resident species (game and non-game) Lake Merwin trap, Pennsylvania trap, beach seine, angling.

75-000214 Hoffman, G. L. (U.S. FWS, Fish Farming Exp. Sta., Box 860, Stuttgart, AR 72160) LESIONS DUE TO INTERNAL HELMINTHS OF FRESHWATER FISHES. IN W.E. Ribelin and G. Migaki, eds. The Pathology of Fishes, Univ. Wis. Press, Madison. 151-187. 1975. SFA 20(3).

Helminths are very common in freshwater fishes. Very few lesions have been attributed to intestinal forms. /Crepidostomum farionis/ has been reported as an enteric pathogen and I have observed intestinal hemorrhage and death caused by, or associated with, the spined nematode /Spinitectus/ sp.

Histozoic helminths, particularly migrating forms, cause greater damage, although cellular responses are usually less pronounced in fishes than in homeotherms. In severe cases hyperemia, hemorrhage, cellular infiltration, hyperplasia, fibrosis, calcification, and necrosis are seen. In some cases there is practically no host response.

After encystment and fibrotic encapsulation, many larval helminths

75-000214 CONTINUED
produce no further obvious damage except pressure on adjacent host tissues (16). The most comprehensive work on fish response to infective agents is that of Reichenbach-Klinke (31).
Herein are reviewed selected examples of lesions caused by trematodes, cestodes, nematodes, and acanthocephalans of freshwater fishes.

75-000215 Lightner, D. V.; Heineke, D. A. (Environ. Res. Lab., Tucson Int. Airport, Tuscon, AZ 85706) A THYROID TUMER IN A SHEEPSHEAD MINNOW (/CYPRINODON VARIEGATUS/) FROM THE GULF OF MEXICO. Trans. Am. Fish. Soc. 104 (1): 138-139. Jan. 1975. SFA 20(3).
An adenoma of the thyroid of the brackish water sheepshead minnow (/Cyprinodon variegatus/) appeared after the fish had been held in a saltwater aquarium with other fish. The tumor appeared to be well delineated grossly. Microscopically, the tumor was invasive into adjacent gill tissues but was without mitotic figures.

75-000216 Margolis, L.; Kabata, Z.; Parker, R. R. (Dep. Environ., Pacific Biol. Sta., Nanaimo, B.C. V9R 5K6, Can.) CATALOGUE AND SYNOPSIS OF /CALIGUS/, A GENUS OF COPEPODA (CRUSTACEA) PARASITIC ON FISHES. Bull. Fish. Res. Board Can. 192. vi + 117p. 1975. In English with French summ. SFA 20(3).
This book is a detailed source of literature information on the parasitic copepod genus /Caligus/. The catalogue gives in capsule form the contents of all publications known to us on members of this genus. In all, 315 nominal species of /Caligus/ are catalogued. The synopsis gives information on synonymy and distribution for 208 species of /Caligus/ currently ranked as valid. When deemed necessary, comments on published records, validity of species, and hosts are provided. The synopsis is followed by four lists: species transferred to other genera; junior synonyms; /nomina nuda/, /species inquirendae/, and rejected names; and misspellings. The work concludes with a comprehensive bibliography.

75-000217 Rucker, R. R. (U.S. FWS, West. Fish Dis. Lab., Seattle, WA 98115) EXCESS NITROGEN GAS IN WATER NOT A CAUSE OF COAGULATED YOLK DISEASE IN CHINOOK SALMON. Prog. Fish-Cult. 37 (2): 101-102. Apr. 1975. SFA 20(3).
Chinook salmon (/Onchorhynchus tshawytscha/) eggs reared in water containing 123 percent N(2) and 103 percent O(2) through 1 week after hatching did not develop white spot or coagulated yolk disease even after being removed to normal water. Fingerlings from some eggs subjected to extemely low oxygen levels developed abnormalities.

75-000218 Scott, J. S. (Dep. Environ., Biol. Sta., St. Andrews, NB E0G 2X0, Can.) GEOGRAPHIC VARIATION IN INCIDENCE OF TREMATODE PARASITES OF AMERICAN PLAICE (/HIPPOGLOSSOIDES PLATESSOIDES/) IN THE NORTHWEST ATLANTIC. J. Fish. Res. Board Can. 32 (4): 547-550. Apr. 1975. In English with French summ. SFA 20(3).
The digenetic trematodes /Steringotrema ovacutum/, /Zoogonoides viviparus/, /Derogenes varicus/, /Lecithaster gibbosus/, /Fellodistomum furcigerum/, and /Stenakron vetustum/ were common in American plaice (/Hippoglossoides platessoides/) from the southern Gulf of St. Lawrence, Scotian Shelf, and northeast Gulf of Maine in the summers of 1971 and 1972. Levels of incidence of the trematodes in different areas within the region are compared. /Steringotrema ovacutum/, /Z. viviparus/, and /F. furcigerum/ may be useful as biological indicators in plaice in the Northwest Atlantic.

75-000219 Scott, J. S. (Dep. Environ., Biol. Sta., St. Andrews, NB EOG 2X0, Can.) INCIDENCE OF TREMATODE PARASITES OF AMERICAN PLAICE (/HIPPOGLOSSOIDES PLATESSOIDES/) OF THE SCOTIAN SHELF AND GULF OF ST. LAWRENCE IN RELATION TO FISH LENGTH AND FOOD. J. Fish. Res. Board Can. 32 (4): 479-483. Apr. 1975. In English with French summ. SFA 20(3).

the following digenetic trematodes were found in the alimentray tract of American plaice (/Hippoglossoides platessoides/) from the Scotian Shelf and Gulf of St. Lawrence: /Derogenes varicus/, /Fellodistomum furcigerum/, /Lecithaster gibbosus/, /Stenakron vetustum/, /Steringotrema ovacutum/, /Zoogonoides viviparus/, /Hemiurus levinseni/, /Otodistomum veliporum/ (larvae), /Podocotyle atomon/, /Prosorhyncus squamatus/.

The incidence of several trematode species changed with length of fish and associated changes in the fish's diet. Incidence of /D. varicus/ and /S. vetustum/ decreased with increase of host length, whereas incidence of /R. ovacutum/ and /Z. viviparus/ increased. /Lecithaster gibbosus/ and /S. furciger/ showed little change in incidence. Correlations between parasite incidence and frequency of occurrence of food items indicated that small crustaceans may be intermediate hosts for /S. vetustum/ and /D. varicus/; sea urchins may be intermediate hosts for /R. ovacutum/ and brittle stars for /Z. viviparus/.

75-000220 Stockley, C. (Wash. Dep. Fish., Vancouver 98661) ODONTOGENIC TUMORS OF SALMON. Prog. Fish-Cult. 37 (1): 62. Jan. 1975. SFA 20(3).

A Columbia River spring chinook salmon was taken with fibroameloblastomas budding from all tooth-bearing surfaces and some gillrakers. The fish was anemic. (RS)

POLLUTION

75-000221 Bible, J. L. (Dep. Biol., W.Va. Univ., Morgantown 26506) AN ANALYSIS OF THE ZOOPLANKTON COMMUNITY IN AN ACID POLLUTED RESERVOIR. Proc. W.Va. Acad. Sci. 44 (1): 32-39. 1972. SFA 20(3).

Since its construction in 1929, Cheat Lake has been polluted by acid mine drainage. The reservoir's three backwaters are partially isolated from the main reservoir and do not receive acid except occasionally from the main reservoir. The present study examined stations in the main reservoir and two in its backwaters to determine the extent of acid mine pollution and its possible effect on the zooplankton community.

Chemical analyses indicate water in the main reservoir has high acidity and low pH, hardness and alkalinity. However, the backwaters have little or no acidity, higher pH, hardness and alkalinity than the main reservoir.

Community coefficients indicate zooplankton communities in the backwaters are similar to each other but different from the zooplankton in the main reservoir. In addition, zooplankton biomass/m^3 was much greater in the backwaters, as was biomass/m^2. The effects of reduced water quality and zooplankton abundance in the main reservoir compared with conditions in the backwaters provide a basis for further study.

75-000222 Canaday, J. T.; Sack, W. A. (Va. State Water Contr. Board, P.O. Box 11143, Richmond 23230) HISTORICAL AND EXISTING NUTRIENT LEVELS IN THE MONONGAHELA RIVER IN WEST VIRGINIA AS RELATED TO EUTROPHICATION POTENTIAL. Proc. W.Va. Acad. Sci. 46 (1): 17-26. 1974. SFA 20(3).

Various programs are underway to reduce the acid load in the Monongahela River. Reduction in acidity might in turn, allow an increased rate of eutrophication. A short range study (7 months) was made at 6 sampling stations to determine existing values of pH, phosphorus, nitrogen, and organic carbon. Historical data (1955-1970) then was gathered for comparison with existing levels.

The historical pH data were found to cycle with no strong pH trend indicated. Historical "mean pH" and existing "mean pH" were very close. Existing inorganic nitrogen values of around 1.0 mg/l were slightly higher than historical values. Existing mean total phosphorus level was highest below Morgantown reaching a value of 0.12 mg/l. High flows greatly increased total phosphorus levels suggesting scour of phosphorus rich sediments. Organic carbon levels varied from 1.0 to 5.0 mg/l.

75-000223 Clarke, R. McV. (Inquiries to: Res. Dev. Dir., Freshwater Inst., Winnipeg, MB, Can.) THE EFFECTS OF EFFLUENTS FROM METAL MINES ON AQUATIC ECOSYSTEMS IN CANADA. A LITERATURE REVIEW. Environ. Can., Fish. Mar. Serv., Res. Dev. Dir., Tech. Rep. No. 488. v + 150p. 1974. In English with French summ. SFA 20(3).

Metal mine effluents are a complex of components, including metals, sulphur compounds and organic reagents, many of which may have deleterious effects on aquatic exosystems. Information on the toxicity of 47 components or groups of components is reviewed. Twenty-four of 26 components for which data were available were present in the effluent from at least one Canadian metal mine at concentrations that are potentially lethal to aquatic organisms. Despite many factors, such as pH, temperature and hardness, affecting the toxicity of mine effluent components, effluents from nine of the eleven mines for which data were available were lethal to fishes in 96 hrs. or less. The major toxicants in the lethal effluents were considered to be heavy metals, arsenic, suspended solids, pH or cyanide. Changes in levels of suspended solids and siltation, heavy metals, total dissolved solids, pH, hardness, sulphate or arsenic were the major chemical changes in water receiving discharged mine effluents. The aquatic biota were adversely affected by the discharge of mine effluents at 19 of 22 localities; the density and composition of the benthic fauna was altered at 16 localities, fish communities were reduced or altered at eight localities, and the plankton community was altered at one locality. Productivity was decreased at one locality, and this was inferred at another locality.

75-000224 Cumont, G.; Viallex, G.; Lelievre, H.; Bobenrieth, P. (Lab. Cent. Hyg. Aliment., 43 Rue de Dantzig, 75015 Paris, France) CONTAMINATION DES POISSONS DE MER PAR LE MERCURE. [CONTAMINATION OF SEA FISH BY MERCURY.] Rev. Int. Oceanogr. Med. 28: 95-127. 1972. In French with English summ. SFA 20(3).

The research and the determination of mercury in the muscle of fish of various species, origin and dimensions show that the concentration of this metal is inferior to norms admitted to-day in most cases.

However, the accumulation of mercury is always proportionnal to the weight of the fish. Consequently, the big individuals at the end of the food chains have concentrations superior to these norms.

Fish from some areas show abnormally high rates, which indicate local pollution. (Auth. Summ.)

75-000225 Diehl, W. T. (Dep. Biol., W.Va. Univ., Morgantown 26506) A COMPARATIVE STUDY OF PLANKTON RESPIRATION IN AN ACID POLLUTED LAKE AND ITS ACID FREE EMBAYMENTS. Proc. W.Va. Acad. Sci. 44 (1): 24-32. 1972. SFA 20(3).

Plankton community respiration rates were measured in both the acid polluted impoundment and acid free backwaters of Cheat Lake, West Virginia. Six hour dark bottle respiration experiments were employed and the following mean planktonic community respiration rates were determined as mg O(2)/l/day: 0.90 near the dam (pH 4.1), 1.47 in Ruble's Run (pH 6.2), and 2.42 in Morgan's Run (pH 6.2). All rates were significantly different at the 0.01 confidence level.

The chemical parameters tested, specific conductivity, pH, total iron, and hot acidity were all significantly different (p less than 0.01) when comparing both backwaters to the Dam Station. All parameters, except specific conductivity, were found not significantly different (p greater than 0.05) when comparing the two backwaters. At the Dam Station it appears that acid pollution limits plankton abundance, thus producing lower community respiration rates. However, no acid pollution is evident in either backwater. Therefore, the primary difference in plankton community respiration between Ruble's Run and Morgan's Run is probably due to increased planktonic abundance in the Morgan's Run backwater. This planktonic abundance difference may be the result of a nutrient limiting factor, as suggested by the specific conductivity differences between these two backwaters.

75-000226 Edens, D. (Dep. Biol., W.Va. Univ., Morgantown 26506) A COMPARATIVE STUDY OF CHEMICAL LOADINGS OF ACID AND NON-ACID TRIBUTARIES OF CHEAT LAKE, WEST VIRGINIA. Proc. W.Va. Acad. Sci. 46 (1): 45-52. 1974. SFA 20(3).

Cheat Lake, West Virginia, receives acid mine drainage from Cheat River and from some of the small streams which are direct tributaries to the lake. The objective of this study was to compare concentrations and loadings of selected water quality parameters of acid and non-acid tributaries of Cheat Lake. Three acid streams, Canyon Run, Sunnyside Run, and Tower Run, and five non-acid streams, Maple Run, Morgan Run, Cole's Run, Quarry Run, and Rubles Run, were sampled monthly from June, 1973, through January, 1974. Loadings were calculated from concentration and discharge measurements.

The acid streams of this study can be distinguished from the non-acid streams on the basis of all parameters studied, except nitrate-nitrogen concentration, nitrate-nitrogen loading, silicate loading, and potassium concentration. Maple Run and Quarry Run can be distinguished from the other non-acid streams when concentrations and loadings of selected ions are based upon drainage area. This difference is not apparent when considering concentrations and loadings alone.

75-000227 Hall, J. W.; Arnold, J. C.; Waller, W. T.; Cairns, J., Jr. (Health Protect. Br., Dep. Natl. Health Welfare, Ottawa, Can.) A PROCEDURE FOR THE DETECTION OF POLLUTION BY FISH MOVEMENTS. Biometrics 31 (1): 11-18 Mar. 1975. SFA 20(3).

An "alarm" system using fish movements has recently been developed to provide rapid information about accidental spills of pollutants. The data are the realization of a non-stationary stochastic process which takes on discrete values. By the use of the Camp-Paulson approximation, the process is transformed to a strictly stationary one for which calculations are tractable. A procedure is then presented to detect the presence of pollutants. Tests with real data indicate that it detects them sooner than the method used previously.

75-000228 Hocutt, C. H.; Kaesler, R. L.; Masnik, M. T.; Cairns, J. Jr. (VPI & SU, Blacksburg, VA 24061) BIOLOGICAL ASSESSMENT OF WATER QUALITY IN A LARGE RIVER SYSTEM: AN EVALUATION OF A METHOD FOR FISHES. FAO, EIFAC/74/I/Symp. 55: 1-20. Mar. 1974. In English with French summ. SFA 20(3).

Fish have certain disadvantages as indicators of stress conditions in aquatic systems. They are mobile and can migrate to and from stressed areas at will if not so drastically affected that movement is curtailed. Furthermore, data gathering may be highly qualitative and not easity interpreted. The public, however, more often focuses its attention on fish than other aquatic organisms and is not fully satisfied about the health of an aquatic system unless fish information is available. This study provides data on fish collected during the summers 1971 and 1972 from the New River in the vicinity of a synthetic fibers plant, Pearisburg, Virginia. These data were analyzed by two methods and constrasted: the diversity index (d) of Wilhm and Dorris (1968) and the Jaccard (1908) similarity coefficient (S-j). The former is a method currently used in monitoring aquatic ecosystems and is a function of the numbers and kinds of species found. The latter analyzes only presence or absence data at each station. S-j was easily adapted to this investigation, provided a more critical method of analyzing data, especially where data were redundant, and is recommended as a method for the biolcgical assessment of water quality.

75-000229 Hocutt, C. H.; Drawas, N. M. (VPI & SU, Blacksburg, VA 24061) AN ECOLOGICAL RECONNAISSANCE OF THE WEST BRANCH OF THE SUSQUEHANNA RIVER, CLEARFIELD COUNTY, PENNSYLVANIA. ERT Comp. Proj. Rep. M-0087. 49p. Apr. 1975. SFA 20(3).

An ecological reconnaissance of the West Branch of the Susquehanna River in Clearfield County, Pennsylvnia was conductd in the fall 1974. The objectives of the investigation were to (1) determine the extent of recovery of the West Branch from acid mine drainage, and (2) to determine the relative influence of a fossil fuel plant on the aquatic ecology of the river. A total of 17 species of fish and 41 macroinvertebrate taxa were collected from the study area.

75-000230 Hoehn, R. C.; Stauffer, J. R.; Masnik, M. T.; Hocutt, C. H. (VPI & SU, Blacksburg, VA 24061) RELATIONSHIPS BETWEEN SEDIMENT OIL CONCENTRATIONS AND THE MACROINVERTEBRATES PRESENT IN A SMALL STREAM FOLLOWING AN OIL SPILL. Environ. Lett. 7 (4): 345-352. 1974. SFA 20(3).

A study was conducted to assess the effects of an oil spill on the macroinvertebrate populations in a small creek in Virginia. Sediments were extracted with hexane, and the residue concentrations were correlated with the numbers and diversities of macroinvertebrates collected downstream of the spill. Based on the available data, it was concluded that the effect of the oil spill was a toxic one rather than one of rendering the sediments unsuitable for colonization.

75-000231 Knieper, L. H.; Culley, D. D., Jr. (Sch. of Forest. Wildl. Manage., La. State Univ., Baton Rouge 70803) THE EFFECTS OF CRUDE OIL ON THE PALATABILITY OF MARINE CRUSTACEANS. Prog. Fish-Cult. 37 (1): 9-14. Jan. 1975. SFA 20(3).

/Penaeus aztecus/, /P. setiferus/, and /Callinectes sapidus/ exposed to sublethal concentrations of two crude oils for 48 h and offered to a panel of 10 judges in a triangular taste test indicated a significant difference in the effect of the two oils on the taste of each species of shrimp but not on crabs. The crabs were the least

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affected, exhibiting 620 ppm as the minimum concentration for one crude oil creating a significant off-taste, i.e., the taste threshold. The judges showed a mimimum taste threshold concentration of 82 ppm for brown shrimp and 49 ppm for white shrimp. Judges with sensitive taste abilities detected off-flavor in shrimp exposed to a 5-ppm oil concentration.

75-000232 Penrose, W. R.; Black, R.; Hayward, M. J. (Dep. Environ., Biol. Sta., St. John's, Nfld., Can.) LIMITED ARSENIC DISPERSION IN SEA WATER, SEDIMENTS, AND BIOTA NEAR A CONTINUOUS SOURCE. J. Fish Res. Board Can. 32 (8): 1275-1281. Aug. 1975. In English with French summ. SFA 20(3).

Moreton's Harbour, Newfoundland, has been exposed to arsenic-bearing drainage and leaching from a stibnite mine for at least 38 yr and possible longer than 84 yr. Measurements of inorganic arsenic in sea water and sediments and total arsenic in some marine organisms revealed a very limited influence of continuous exposure to arsenic in the small harbor. Arsenic concentrations in surface water declined to normal within 200 m, and in sediments within 50 m. Animals did not show significantly higher levels nearer the mine, with the exception of the sea urchin /Strongylocentrotus droebachiensis/, which accumulated significantly higher levels of arsenic adjacent to the mine site.

75-000233 Rankin, D.; Keller, E. C., Jr. (Dep. Biol., W.Va. Univ., Morgantown 26506) PHYTOPLANKTON GENERIC DIVERSITY AND BIOMASS ESTIMATES OF A MONONGAHELA RIVER ACID CONFLUENCE. Proc. W.Va. Acad. Sci. 45 (2): 169-177. 1973. SFA 20(3).

Water samples were taken from the confluence of Robinson Run and the Monongahela River in northern West Virginia in order to obtain information on the effect of an acid stream on generic diversity. Samples at each station were examined to determine generic diversity, biomass, density and distribution of phytoplankton in relation to an acid stream. The parameters--pH, hot and cold acidity, dissolved oxygen, percent saturation of oxygen and water temperature--were also measured with analyses of variance and correlation performed on the data.

The generic diversity and density were found to be significantly decreased in the acid stream with /Euglena/ being the only genus found. Both diversity and density slowly increased down river with increasing distance from the confluence. The highest generic diversities and densities were found upriver from the confluence. Significant differences in the chemical parameters of Robinson Run were also found. High acidity, as measured by hot and cold acidity values, appeared to be a significant factor in determining the diversity and density indicies.

75-000234 Thompson, B. (Inquiries to: Res. Dev. Dir., Freshwater Inst., Winnipeg, MB, Can.) THE EFFECTS OF EFFLUENT FROM THE CANADIAN TEXTILE INDUSTRY ON AQUATIC ORGANISMS. Environ. Can., Fish. Mar. Serv., Res. Dev. Dir., Tech. Rep. No. 489. vi + 99p. 1974. In English with French summ. SFA 20(3).

This literature review presents production figures for the Canadian textile industry, explains processes used in textile manufacture, and describes the properties of waste water from textile processes, with special reference to the Canadian industry. The toxicity to aquatic organisms of synthetic detergents, dyes, dye carriers, acids, salts and various other process chemicals is evaluated. It is concluded that important areas for future research are the toxicity of dyes, dye carriers and other phenolic compounds, and their toxicity when mixed

75-000234 CONTINUED
with other components of the effluent.

75-000235 Tsai, C. EFFECTS OF SEWAGE TREATMENT PLANT EFFLUENTS ON FISH: A REVIEW OF LITERATURE. Chesapeake Res. Consortium, Inc., CRC Publ. No. 36. vii + 229p. March 1975. SFA 20(3).

This literature review was a part of the research project, "Research on the Chesapeake Bay to provide a knowledge base for waste outfall management," conducted by the Chesapeake Research Consortium, Inc.

The primary objective of this review was to prepare a digest of the known effects of sewage treatment plant effluents on estuarine fish drawing from world wide literature. Most studies on the effects of sewage effluents on fish life to date, however, have been devoted to freshwater fish; very little has been done on estuarine and marine fishes. It was considered that many studies which have been done on freshwater fish are essential references for understanding estuarine and marine fish. Thus, in this review not only estuarine fishes but also freshwater and marine fish are included. It is hoped that this review will be useful for management agencies at federal, state, and local government levels which deal with the problem of sewage disposal and the protection of aquatic life. It will also provide the basic knowledge for designing future research projects.

Search of literature was made from July 1973 to June 1974, mainly through Water Pollution Abstracts, Pollution Abstracts, Biological Abstracts, Commercial Fisheries Abstracts, Sport Fishery Abstracts, Selected Water Research Abstracts, Water Research Catalogue, and other available sources. Only that literature relating to domestic sewage was searched. Since domestic sewage contains constituents which directly or indirectly affect fish life, literature relating to known toxic or damaging constituents, and water quality parameters which are known to be affected by domestic sewage effluents damaging to fish life, has been searched. The examples relate to domestic sewage effluents as a whole, as well as residual chlorine and chloramines, detergents, ammonia, hydrogen sulfide, sludge, dissolved oxygen, algae, and bacteria. (From Auth. Intro.)

75-000236 Williams, P. M.; Robertson, K. J. (Inst. Mar. Resour., Univ. Calif., La Jolla 92037) CHLORINATED HYDROCARBONS IN SEA-SURFACE FILMS AND SUBSURFACE WATERS AT NEARSHORE STATIONS AND IN THE NORTH CENTRAL PACIFIC GYRE NOAA Fish. Bull. 73 (2): 445-447. Apr. 1975. SFA 20(3).

In the North Central Pacific Gyre, the concentration of DDT residues in surface films and subsurface waters was less than 0.03 ng/liter for all samples, while the PCB content was two orders of magnitude higher, and PCB's were always present. In the California and Mexican coastal waters, both PCB and DDT residue concentrations in the surface films were slightly higher than in the 1-2 m subsurface waters of the nearshore California current. (RS)

TOXICOLOGY; BIOASSAYS

75-000237 Adams, E. S. (Dep. Zool., Univ. N.H., Durham 03824) EFFECTS OF LEAD AND HYDROCARBONS FROM SNOWMOBILE EXHAUST ON BROOK TROUT (/SALVELINUS FONTINALIS/). Trans. Am. Fish. Soc. 104 (2): 363-373. Apr. 1975. SFA 20(3).

Lead and hydrocarbons from snowmobile exhaust were found in the water at high levels during the week following ice-out in a Maine pond. Fingerling brook trout (/Salvelinus fontinalis/) held in fish cages in the pond showed lead and hydrocarbon uptake. These

75-000237 CONTINUED
contaminants accumulated during the previous winter when snowmobile operation on the pond was equivalent to one snowmobile burning 250 liters of fuel per season on a .405 hectare pond with average depth of 1 m. Lead content of the water rose from 4.1 ppb before snowmobiling to 135 ppb at ice-out; exposed trout contained 9 to 16 times more lead than controls. Hydrocarbon levels undetectable prior to snowmobiling reached 10 ppm in the water and 1 ppm in exposed fish.

Trout held in aquaria for 3 weeks in melted snow containing three different concentrations of snowmobile exhaust also showed lead and hydrocarbon uptake. Their digestive tract tissue contained the most led (2 ppm) and gills the least (0.2 ppm).

Stamina, as measured by the ability to swim against a current, was significantly less in trout exposed to snowmobile exhaust than in control fish.

75-000238 Bahner, L. H.; Nimmo, D. R. (U.S. EPA, Gulf Breeze Environ. Res. Lab., Sabine Island, Gulf Breeze, FL 32561) A SALINITY CONTROLLER FOR FLOW-THROUGH BIOASSAYS. Trans. Am. Fish. Soc. 104 (2) : 388-389. Apr. 1975. SFA 20(3).

An electro-mechanical device has been constructed to monitor and dilute seawater to a constant salinity for flowing-water bioassays. It has been used successfully in pesticide bioassays and requires little maintenance.

75-000239 Becker, A. J., Jr.; Keller, E. C., Jr. (Dep. Biol., W.Va. Univ., Morgantown 26506) THE EFFECTS OF IRON & SULFATE COMPOUNDS ON THE GROWTH OF /CHLORELLA/. Proc. W.Va. Acad. Sci. 45 (2): 127-135. 1973. SFA 20(3).

Physiological and morphological evidence is presented indicating the effects of two major chemical Acid Mine Water constituents, compounds of iron and sulfur, on the growth of /Chlorella vulgaris/ (Pratt). Axenic algal cultures were grown in modified Beijerinck's medium to which one of the iron or sulfate-compound test substances had been added. Three different concentrations of each of the three iron compounds and three sulfate compounds were considered. Three replicates of each constituent concentration combination and the control culture were used. Culture tubes were maintained under constant light and ambient temperature conditions and were intermittently agitated by a humidified sterile air system. Five physiological growth parameters were considered: maximum population, maximum population growth rate, maximum specific growth rate, average time to attain maximum population growth rate, and generation time. Four morphological characteristics (cell size, shape, color and aggregate arrangement) were also observed. We conclude that: 1) the initial addition of iron results in an increase in population number, while the addition of sulfate results in a decrease, except in the case of the iron-sulfate interaction where the sulfate appears to enhance the effect of the iron, 2) continued increase in concentration of any of the test substances results in an accompanying decrease in population numbers, and 3) in high concentrations all of the test substances create conditions lethal to the algal population.

75-000240 Bennett, V. E. (Mich. Dep. Nat. Resour., Lansing 48926) A POSSIBLE REACTION OF ATLANTIC SALMON /(SALMO SALAR/) TO INJECTED CHLORAMPHENICOL. Prog. Fish-Cult. 37 (2): 114. Apr. 1975. SFA 20(3).

Atlantic salmon (/Salmo salar/) injected with Chloramphenicol intraperitoneally at 18.7 mg/kg evidenced reddish hivelike sores, accompanied by an increase in mortality rate. The symptoms could not be duplicated by similar injection of either rainbow trout (/S. gairdneri/) or brown trout (/S. trutta/). The reaction is therefore theorized to have been a species specified reaction to Chloramphenicol.

75-000241 Benoit, D. A. (U.S. EPA, 601 Congdon Blvd., Duluth, MN 55804) CHRONIC EFFECTS OF COPPER ON SURVIVAL, GROWTH, AND REPRODUCTION OF THE BLUEGILL (/LEPOMIS MACROCHIRUS/). Trans. Am. Fish. Soc. 104 (2): 353-358. Apr. 1975. SFA 20(3).

During a 22-month exposure of bluegills to copper in soft water, adult bluegill survival was reduced, growth was retarded, and spawning was inhibited at 162 ug/liter of copper (Cu). Tissue-residue analysis of the gill and liver indicated that significant quantities of copper had accumulated in these tissues at test-water concentrations of 40-162 ug Cu/liter. Larval bluegill survival after 90 days' exposure to copper was adversely affected at 40-162 ug Cu/liter. The maximum acceptable toxicant concentrations (MATC) for bluegills exposed to copper in water with a hardness of 45 mg/liter (as CaCC(3)) and a pH range of 7-8 lies between 21 and 40 ug Cu/liter. The mean 96-hour TL50 for juvenile bluegills is 1,100 ug Cu/liter, and the application factor (MATC/96-h TL50) lies between 0.02 and 0.04.

75-000242 Brown, D. A.; McLeay, D. J. (B.C. Res. Counc., 3650 Westbrook Crescent, Vancouver 167, BC, Canada) EFFECT OF NITRITE ON METHEMOGLOBIN AND TOTAL HEMOGLOBIN OF JUVENILE RAINBOW TROUT. Prog. Fish-Cult. 37 (1): 36-38. Jan. 1975. SFA 20(3).

Changes in total hemoglobin and methemoglobin were measured in juvenile rainbow trout exposed to sublethal concentraticns of sodium nitrite for 96 h. The 96-h LC50 value for sodium nitrite under continuous flow-through conditions was 230 ug NO(2)-N/l. Total hemoglobin was reduced significantly at concentrations of 100 ug NC(2)-N/l and greater. Methemoglobin was increased significantly at all nitrite concentrations administered, from a control value of 0.9 percent of total hemoglobin to approximately 4 percent at 15-25 ug NO(2)-N/l, 20 percent at 50-100 ug NO(2)-N/l, and 80 percent at 200-300 ug NO(2)-N/l.

75-000243 Burnham, B. L.; Peterka, J. J. (U.S. EPA, Kansas City, KS) EFFECTS OF SALINE WATER FROM NORTH DAKOTA LAKES ON SURVIVAL OF FATHEAD MINNOW (/PIMEPHALES PROMELAS/) EMBRYOS AND SAC FRY. J. Fish. Res. Board Can. 32 (6): 809-812. June 1975. In English with French summ. SFA 20(3).

Eggs and sac fry of the fathead minnow (/Pimephales promelas/) were subjected in the laboratory to various dilutions of water cbtained from four saline North Dakcta lakes; three were sodium sulfate-, one a sodium chloride-type lake. In water from the latter, the percent of fertilized eggs surviving as sac fry for 5 days remained the same as the percent hatched: about 90 percent at treatment levels of 500 - 12,000 umho and 68 percent in undiluted lake water of 18,000 umho. In sodium sulfate-type water, however, about 92 percent of the fertilized eggs hatched at treatment levels of 500 up to only 6,000 umho, with about 82 percent living as sac fry for 5 days in water from two of the lakes, and only about 54 percent living for 5 days in dilutions made

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from the most saline lake (lake water of 25,000 umho). No sac fry survived for 5 days after hatching in sodium sulfate-type water of 12,000 umho. From laboratory bioassays and field observations, we estimated sodium sulfate-type water exceeding 8,000 umhc during reproductive periods may decrease survival of sac fry.

75-000244 Carpenter, C. B. (Dep. Biol., Bethany Coll., Bethany, WV 26032) EFFECTS OF VARIOUS CATIONS AND ANIONS ON SEVERAL SPECIES OF CLADOCERANS DETERMINED BY FACTORIAL EXPERIMENTS ON SURVIVAL. Proc. W.Va. Acad. Sci. 44 (1): 57-63. 1972. SFA 20(3).
Clones of /Daphnia magna/ Straus, /Daphnia pulex/ (de Geer) and /Ceriodaphnia reticulata/ Jurine were studied in laboratory and field experiments with respect to the effects of the cations and anions making up the total alkalinity component of a fresh water pond. A relationship between the seasonal fluctuation of the total alkalinity and the populations of these organisms in the pond was found. LD(50) values for KHCO(3), NaHCO(3), KCl, and NaCl have been determined. A factorial design experiment was used to analyze these values to determine the effects of these anions and cations on the organisms.

75-000245 Chandler, J. H., Jr.; Partridge, S. K. (U.S. FWS, Southeast. Fish Contr. Lab., Warm Springs, Ga. 31830) A SOLENOID-ACTIVATED CHEMICAL-METERING APPARATUS FOR USE IN FLOW-THROUGH TOXICITY TESTS. Prog. Fish-Cult. 37 (2): 93-95. Apr. 1975. SFA 20(3).
The described chemical-metering apparatus is easily adapted to most flow-through (diluter) systems in present use. It is dependable, costs about $40, and may be fabricated from readily available components. The coefficient of variation of the metering apparatus (4.7) compares favorably with that of more complex and expensive toxicant delivery systems.

75-000246 Chervinski, J. (Fish Aquaculture Res. Sta. Dor, Israel) EXPERIMENTAL ACCLIMATIATION OF /LIZA AURATA/ (RISSO) TO FRESHWATER. Bamidgeh 27 (2): 49-53. June 1975. SFA 20(3).
Experiments were conducted to determine the adaptability of young golden gray mullet /Liza aurata/ (Risso) to various salt concentrations. Young golden gray mullet (total length 20-40mm) were subjected to abrupt and gradual changes from saltwater to freshwater media. No mortality occurred with salinity decrease, even in a abrupt change from 100 percent seawater (S=39°/oo) to 10 percent seawater (S=3.9°/oo). All fish died with abrupt salinity decrease from 100 percent seawater to 100 percent freshwater (S=0.4°/oo). With a gradual decrease from 10 percent freshwater (S=0.4°/oo) all survived. The growth rate of young /L. aurata/ (70-80 mm) was observed in a freshwater pond.

75-000247 Decker, C.; Menendez, R. (W.Va. Dep. Nat. Resour., P.O. Box 67, Elkins 26241) ACUTE TOXICITY OF IRON AND ALUMINUM TO BROOK TROUT. Proc. W.Va. Acad. Sci. 46 (2): 159-167. 1974. SFA 20(3).
Pollution of rivers and streams in West Virginia due to acid mine drainage is a concern to both the biologist and the general public. A series of tests was conducted simulating acid mine drainage.
LD-50 values for iron with brook trout were established for different neutral and acidic media as being 1.75 mg/l in a pH 7.0, 0.48 mg/l at a pH 6.0, and 0.41 mg/l at a pH 5.5. LD-50 values for aluminum were also established as being 3.60 mg/l at pH 6.5, 4.45 mg/l at a pH 6.0, and 4.00 mg/l at pH 5.5.

75-000248 DeFoe, D. L. (U.S. EPA, Nat. Water Quality Lab., Duluth, MN 55804) MULTICHANNEL TOXICANT INJECTION SYSTEM FOR FLOW-THROUGH BIOASSAYS. J. Fish. Res. Board Can. 32 (4): 544-546. Apr. 1975. In English with French summ. SFA 20(3).

A mechanical injection system needing little maintenance is described which offers a dependable and flexible method for maintaining multiple toxicant concentrations in flow-through bioassays. Falling water from a series of water-metering cells similar to those of a proportional diluter, activates a series of mechanical syringe injectors. The system dispenses equal amounts of toxicant dispersants (solvents, wetting agents, or additives) to all toxicant concentrations and to a dispersant control and allows changing unlimited toxicant concentrations independently of each other.

75-000249 Donaldson, E. M.; Dye, H. M. (Dep. Environ., Vancouver Lab., West Vancouver, BC V7V 1N6, Can.) CORTICOSTEROID CONCENTRATIONS IN SOCKEYE SALMON (/ONCORHYNCHUS NERKA/) EXPOSED TO LOW CONCENTRATIONS OF COPPER. J. Fish. Res. Board Can. 32 (4): 533-539. Apr. 1975. In English with French summ. SFA 20(3).

Yearling sockeye salmon (/Oncorhynchus nerka/) were exposed for 1-24 h to 10 to the -7th, 10 to the -6th, or 10 to the -5th molar cupric sulphate in freshwater aquaria. Plasma cortisol, cortisone, and "total" corticosteroid concentrations were measured by a competitive protein binding technique.

Cortisol, cortisone and "total" corticosteroid levels were significantly higher than control concentrations after 1 h of exposure to 10 to the -5th or 10 to the -6thM copper. "Total" corticosteroid and cortisone concentrations were significantly higher than control concentrations after 2 and 4 h of exposure to 10 to the -7thM copper, respectively. Fish exposed to 10 to the -5thM copper died between 8 and 24 h.

The data reflect a rapid corticosteroid stress response to lethal and sublethal concentrations of copper. The technique may be of use for rapid evaluation of effluents containing heavy metals, especially those containing a mixture of toxicants.

75-000250 Edens, D.; Keller, E. C., Jr. (Dep. Biol. W.Va. Univ., Morgantown 26506) THE EFFECTS OF PH ON THE GROWTH OF /CHLORELLA VULGARIS/. Proc. W.Va. Acad. Sci. 45 (2): 112-120. 1973. SFA 20(3).

The pH of modified Beijerinck meduim was adjusted to values of 2.5, 3.5, 4.5, 5.5, and 6.5 with sulfuric acid or hydrochloric acid. No combinations of the acids were used to adjust the pH. Modified Beijerinck medium (pH 6.8) without acid adjustment served as a control. The experimental cultures were maintained under continuous illumination at ambient temperature. Cell counts were made periodically using a Model B Coulter Counter.

Five growth parameters were evaluated: 1) population growth rate (popK); 2) specific growth rate (r(m)); 3) maximum number of cells attained (Nmax); 4) generation time (genT); and 5) time required for a population to reach the midpoint of the maximum popK (G-50). Analyses of variance were performed on the pH groups. The effects of the two acids were tested separately. The effects of the two acids were then combined and the results of the five levels of pH evaluated. The level of pH significantly affected the popK, Nmax, genT, and G-50 final response levels.

75-000251 Eisele, P. J. (Dep. Environ. Health, Univ. Mich., Ann Arbor 48104) A SIMPLE DOSING SYSTEM FOR CONTINUOUS STREAM DOSING. Trans. Am. Fish. Soc. 104 (2): 359-362. Apr. 1975. SFA 20(3).

A simple mechanical dosing apparatus to continuously dose streams with chemical solutions involves a modified Sutro weir and a simple lever-float system. This dosing device is easily constructed, inexpensive, and quite reliable under conditions of minor flow variation (a seasonal fluctuation of one order of magnitude or less). It maintained an average stream concentration variation of only plus or minus 10 percent during a year of low level pesticide dosing.

75-000252 Hollander, E. E.; Avault, J. W., Jr. (Sch. Forest. Wildl. Manage., La. State Univ., Baton Rouge 70803) EFFECTS OF SALINITY ON SURVIVAL OF BUFFALO FISH EGGS THROUGH YEARLINGS. Prog. Fish-Cult. 37 (1): 47-51. Jan. 1975. SFA 20(3).

Laboratory tests were conducted to determine effects of salinity on survival of buffalo fish (/Ictiobus/ spp.) eggs, fry, fingerlings, and yearlings. Bigmouth (/I. cyprinellus/), black (/I. niger/), bigmouth (m) x black (f), and reciprocal hybrids were used in the study.

Eggs of the bigmouth, black, and both hybrids, 1 or 2 days of age, remained viable in 0, 3, 6, 9, 12, and 15 ppt salinities until hatching. Most eggs from all four types of fish hatched into normal live fry in 9 ppt salinity or less. Eggs that hatched in 12 ppt salinity produced fry that lived and had abnormal spinal cclumns. Eggs that hatched in 15 ppt salinity produced fry that died within the first hour after hatching and all had abnormal spinal cclumns.

Thirty-five-day-old bigmcuth and black buffalo fry in 0, 3, 6, 9, 12, and 15 ppt salinities survived best in 9 ppt and pccrest in 0 then 15 ppt. Black buffalo fry, 57-days-old, followed the same pattern as the 35-day-old fry.

Nine-month-old bigmouth and bigmouth x black buffalo fingerlings survived longest in 12 ppt. Very few deaths were recorded in 2, 5, 7, 10, or 12 ppt salinities. Bigmouth buffalo fingerlings exposed to 0, 13, 15, 17, 21, or 23 ppt salinities survived best in 13 ppt.

Bigmouth buffalo yearlings in 0, 5, and 10 ppt salinities lived during the 4-day examination period, but only those in 0- and 5-ppt salinities lived throughout the long-range study. Those in 15 ppt salinity died after 4 hours of exposure. Those in 20 ppt salinity died after 1 hour of exposure.

75-000253 Howard, T. E. (Div. Appl. Biol., B. C. Res., Vancouver, B. C. V6S 2L2, Can.) SWIMMING PERFORMANCE OF JUVENILE COHO SALMON (/ONCORHYNCHUS KISUTCH/) EXPOSED TO BLEACHED KRAFT PULPMILL EFFLUENT. J. Fish. Res. Board Can. 32 (6): 789-793. June 1975. In English with French summ. SFA 20(3).

Maximum critical swimming speeds were not achieved by fingerling coho salmon (/Oncorhynchus kisutch/) in concentrations of bleached kraft pulpmill effluent above a threshold concentration between 10-20 percent of the 96-h LC50. Reduction of swimming performance was related to effluent concentration but not to exposure time after the initial 18 h. Swimming performance returned to control levels for fish tested in water after 6-12 h recovery from exposure to effluent concentrations up to 0.7 LC50. Effluent was rendered nontoxic by aerobic microbiological fermentation but some reduction in swimming performance was measured which was attributed, in part, to the effects of color and lignin materials remaining after treatment.

The results are discussed in relation to the mode of toxic action of bleached kraft pulpmill effluents and their possible impact on aquatic ecosystems.

75-000254 Janeczek, W. A.; Keller, E. C. III; Shoupp, W. J.; Keller, E. C., Jr. (Dep. Biol., W.Va. Univ. Morgantown 26506) THE EFFECTS OF ACID MINE WATER ON GROWTH (NUMBER AND SIZE) OF /CHLORELLA VULGARIS/. Proc. W.Va. Acad. Sci. 44 (1): 40-49. 1972. SFA 20(3).

Growth in /Chlorella vulgaris/ was examined under axenic conditions in a variety of Acid Mine Water (AMW) concentrations, and inorganic nutrient media, to ascertain the relationship between cell number and cell size. It was found that high concentrations of AMW (above 3/16) decreased the average cell size. Further, at concentrations of 3/16 AMW or more, cell number was greatly decreased. Finally, the normal relationship that exists between cell size and cell number during growth was greatly modified by AMW concentrations greater than 3/16.

75-000255 Konikoff, M. (Dep. Biol., Univ. Southwest. La., Lafayette 70501) TOXICITY OF NITRATE TO CHANNEL CATFISH. Prog. Fish-Cult. 37 (2): 96-98. Apr. 1975. SFA 20(3).

Toxicity of nitrite NO(2)- to channel catfish (/Ictalurus punctatus/) was measured by static bioassay. The 24-, 48-, 72-, and 96-h TL(m) values for 40-g fish at 21 degrees C were 33.8, 28.8, 27.3, and 24.8 mg/l, respectively. The blood of nitrite poisoned catfish had a dark chocolate brown color. Nitrite concentrations reach lethal levels in new recirculating culture systems. It is suggested that nitrite toxicity may be a common but overlooked cause of mortality in fish culture.

75-000256 Korn, S.; Earnest, R. (NMFS, Tiburon Fish. Lab., Tiburon, CA 94920) ACUTE TOXICITY OF TWENTY INSECTICIDES TO STRIPED BASS, /MORONE SAXATILIS/. Calif. Fish Game 60 (3): 128-131. July 1974. SFA 20(3).

The acute toxicity of twenty insecticides to juvenile striped bass was determined in saline water. All bioassays were four-day tests using proportional diluters as described to Mount and Brungs (1967).

Endrin, Endosulfan, DDT, and Dursban were the most toxic with Median Lethal Concentration (TL(50)) values of less than 1 ug/l. Carbaryl and Abate were the least toxic with TL(50) values over 1,000 ug/l. DDD, Heptachlor, Methoxychlor, Toxaphene, Aldrin, Lindane, Chlordane, Malathion, Parathion, Dieldrin, E.P.N., Fenthion, Dibrom, and Methyl Parathion were also tested and are listed in order of decreasing toxicity. Some advantages of intermittent verus static bioassay testing are discussed.

75-000257 Kwain, W. (Ont. Minist. Nat. Resour., Sault Ste. Marie, ON P6A 5N9, Canada) EFFECTS OF TEMPERATURE ON DEVELOPMENT AND SURVIVAL OF RAINBOW TROUT, /SALMO GAIRDNERI/, IN ACID WATERS. J. Fish. Res. Board Can. 32 (4): 493-497. Apr. 1975. In English with French summ. SFA 20(3).

Differences in mortality of rainbow trout (/Salmo gairdneri/) embryos were significant (P less than 0.05) when the eggs were exposed to 5, 10, and 15 C and pH levels from 3.0 to 6.0. No embryos survived at pH values below 4.49, regardless of the temperature. The median lethal pH values for rainbow embryos were 4.75 and 5.52 at temperatures of 10 and 5 C, respectively.

Differences in lethal pH values for fingerling rainbow trout were significant (P less than 0.05) when trout were exposed to four test water temperatures (5, 10, 15, and 20 C) and two acclimation temperatures (10 and 20 C). The median lethal pH values of fingerling trout were positively related to the test water temperatures and ranged from 3.86 to 4.49. Resistance of yearling trout to acid waters was higher than that of fingerlings.

75-000258 Land, B. (Inquiries to: Res. Dev. Div., Freshwater Inst., Winnipeg, MB, Can.) THE TOXICITY OF DRILLING FLUID COMPONENTS TO AQUATIC BIOLOGICAL SYSTEMS. A LITERATURE REVIEW. Environ. Can., Fish. Mar. Serv., Res. Dev. Dir., Tech. Rep. No. 487. iv + 33p. 1974. In English with French summ. SFA 20(3).

This report is a literature review on the toxicity tc aquatic biological systems of drilling fluid components used in northern Canada. This review includes aquatic toxicity literature that was available prior to January 31, 1974. The components of drilling fluids include suspended solids, chlorides, alkaline sources, chromium compounds, bactericides, organic polymers, dispersents, defoamers, lubricants and detergents. On the basis of quantities used and of the harmful long-term effects produced, the alkaline sources, bactericides, barium sulphate, bentonite, chromium salts and potassium chloride comprise the major sources of aquatic toxicity.

75-000259 Leach, J. M.; Thakore, A. N. (B. C. Research, Vancouver, B. C. V6S 2L2, Can.) ISOLATION AND IDENTIFICATION OF CONSTITUENTS TOXIC TO JUVENILE RAINBOW TROUT (/SALMO GAIRDNERI/) IN CAUSTIC EXTRACTION EFFLUENTS FROM KRAFT PULPMILL BLEACH PLANTS. J. Fish. Res. Board Can. 32 (8): 1249-1257. Aug. 1975. In English with French summ. SFA 20(3).

Chemical constituents in effluent from the caustic extraction stage of the bleach plant at a western Canada kraft pulpmill were fractionated to identify factors responsible for their toxicity to juvenile rainbow trout (/Salmo gairdneri/). At all stages in the fractionation procedure bioassays were carried out to monitor toxicities of the isolated materials. Five toxic compounds, separated in a pure state from the effluent, were characterized by chromatography, spectroscopy, and chemical synthesis. The compounds and their 96-h median lethal concentrations (LC50) measured in static bioassays were: 3,4,5-trichloroguaiacol (0.75 mg/liter), 3,4,5,6-tetrachloroguaiacol (0.32 mg/liter), monochlorodehydroabietic acid (0.6 mg/liter), dichlorodehydroabietic acid (0.6 mg/liter), 9,10-epoxystearic acid (1.5 mg/liter).

The same compounds were shown to be present in caustic extraction effluents collected from six other western kraft mills. For two samples, the concentration-toxicity graphs from bioassays of solutions containing only the pure toxicants in the amounts found by analysis were similar to those of the actual effluents produced by the mills. Concentrations of the toxic constituents in samples from six different mills were equivalent to 2.3-24 TU (toxic units), confirming that they are important factors in the toxicity of caustic extraction effluents.

75-000260 Maciorowski, H. D.; Kondra P. M. (Dep. Environ., Aquatic Toxic Stud. Div., Winnipeg, Manitoba, Can.) FLOW-THROUGH APPARATUS FOR ACUTE TOXICITY BIOASSAYS WITH AQUATIC INVERTEBRATES. Dep. Environ., Fish. Mar. Serv., Fish. Oper. Dir., Cent. Reg., Data Rep. Ser. No. CEN/T-75-2. vi + 13p. 1975. SFA 20(3).

This paper describes a modification of the Mount proportional diluter which is used for aquatic invertebrate toxicity testing. A discussion of design differences and construction problems is also provided.

75-000261 Maki, A. W.; Geissel, L.; Johnson, H. E. (Environ. Water Qual. Res. Dep., Procter & Gamble Co., Cincinnati, OH 45217) COMPARATIVE TOXICITY OF LARVAL LAMPRICIDE (TFM: 3-TRIFLUOROMETHYL-4-NITROPHENOL) TO SELECTED BENTHIC MACROINVERTEBRATES. J. Fish. Res. Board Can. 32 (8): 1455-1459. Aug. 1975. In English with French summ. SFA 20(3).

The acute toxicity of larval lampricide (TFM: 3-trifluoromethyl-4-nitrophenol) to 35 species of benthic macroinvertebrates was determined in 96-h flow-through tests. The 96-h LC50 values range from 2.1 mg/liter for blackfly larvae, /Simulium pugetense/, to values in excess of 38.0 mg/liter for species with heavy exoskeletons: crayfish (/Orconectes propinquus/), dobsonfly larvae (/Chauloides/ sp.), and dragonfly naiads (/Ophiogomphus/ sp.) Younger individuals of the clam (/Ligumia/ sp.) and the mayfly nymph (/Ephemerella cornuta/) were 2 to 1.5 times more sensitive than larger individuals of the same species. Early emergence of adults and increased locomotor activity were observed among some organisms exposed to sublethal concentrations.

75-000262 Marking, L. L.; Dawson, V. K. (Fish Contr. Lab., La Crosse, WI 54601) METHOD FOR ASSESSMENT OF TOXICITY OR EFFICACY OF MIXTURES OF CHEMICALS. U.S. Fish Wildl. Serv., Invest. Fish Contr. 67. 8p. 1975. SFA 20(3).

The individual toxic contributions of poisons were summed, and the additive toxicity was defined by a linear index for two chemicals in combination. This index expresses the toxicity quantitatively: zero indicates additive toxicity, negative values indicate less than additive toxicity, and positive values indicate greater than additive toxicity. We selected examples from the literature and conducted tests in the laboratory to assess the additive toxicity of selected chemical mixtures to fish. The values ranged from -1.37 for zinc and cyanide to 7.20 for malathion and Delnav. The method quantifies additive toxicity or efficacy and assists in evaluating the advantages as well as environmental hazards resulting from chemical mixtures.

75-000263 May, R. C. (Hawaii Inst. Mar. Biol., P.O. Box 1346, Kaneohe, HI 96744) EFFECTS OF ACCLIMATION ON THE TEMPERATURE AND SALINITY TOLERANCE OF THE YOLK-SAC LARVAE OF /BAIRDIELLA ICISTIA/ (PISCES: SCIAENIDAE). NOAA Fish. Bull. 73 (2) 249-255. Apr. 1975. SFA 20(3).

Eggs of the bairdiella, /Bairdiella icistia/, were fertilized and incubated in various combinations of temperature and salinity, and the salinity and upper thermal tolerances of the yolk-sac larvae were determined. The upper thermal tolerance was enhanced by acclimation to high temperatures and low salinities. Acclimation to low salinities enhanced the lower salinity tolerance of larvae at 24 h after exposure to test conditions, but an acclimation effect on the upper salinity tolerance was not apparent until 48 h after exposure. Yolk-sac bairdiella larvae are more tolerant than the embryonic stages and less tolerant than adults to extremes of temperature and salinity.

75-000264 McBride, J.; Strasdine, G.; Fagerlund, U. H. M. (Dep. Environ., Vancouver Lab., Vancouver, B.C. V6T 1X2, Can.) ACUTE TOXICITY OF KANAMYCIN TO STEELHEAD TROUT (/SALMO GAIRDNERI/). J. Fish. Res. Board Can. 32 (4): 554-558. Apr. 1975. In English with French summ. SFA 20(3).

Kanamycin administration at the recommended dosage for the treatment of fish infected with species of /Aeromonas/ and /Pseudomonas/ was found to be highly toxic to steelhead trout. Descriptions of pathological alterations, both gross and microscopic, as well as plasma cortisol concentrations are provided.

75-000265 McLeay, D. J.; Brown, D. A. (Div. Appl. Biol., B.C. Res., Vancouver, B.C. V6S 2L2, Can.) EFFECTS OF ACUTE EXPOSURE TO BLEACHED KRAFT PULPMILL EFFLUENT ON CARBOHYDRATE METABOLISM OF JUVENILE COHO SALMON (/ONCORHYNCHUS KISUTCH/) DURING REST AND EXERCISE. J. Fish. Res. Board Can. 32 (6): 753-760. June 1975. In English with French summ. SFA 20(3).

In the static study (no exercise), liver glycogen stores were unchanged during 12-h exposure to 0.8 of the 96-h LC50; longer exposures caused a progressive decrease to levels one fifth those of controls at 72 h. Plasma glucose levels in fish held in 0.8 LC50 effluent for 3 - 96 h were elevated; at 96 h, glucose had increased threefold. Mean values for plasma lactate were elevated significantly at 3, 6, 24, 72, and 96 h.

In the exercise (swimming one body length per second)-rest study, muscle glycogen levels decreased 53-78 percent during exercise in water or effluent (0.7 LC50) for 4 - 12 h, and did not recover during 12-h rest in water. Muscle glycogen for fish exercised for 12 h in effluent and then rested for 4 or 12 h in effluent was lower compared to values for fish exercised in effluent and then rested in water. There was no difference in liver glycogen levels of fish exercised in effluent or water for 4-12 h. Values of liver glycogen for fish exercised in effluent for 12 h and then rested for 4, 8, or 12 h in effluent decreased 60-70 percent compared to fish exercised in water for 12 h and then rested in water and by 55-65 percent from fish exercised in effluent for 12 h and rested in water for 4-12 h. Plasma glucose levels were elevated one- to fourfold during exercise in water or effluent. Fish resting in water for 4, 8, or 12 h following exercise in water had relatively stable glucose levels; whereas for fish exercised and then rested in effluent the glucose levels increased twofold during resting. Plasma lactate levels were elevated five- to sixfold during exercise in water or effluent for 4-12 h, declining to values 1-2 times those of stock fish within 4-h rest. Plasma lactate levels for fish exercised in effluent and then rested in effluent or water were continually higher than those for fish exercised and rested in water.

It was concluded that measurement of carbohydrate metabolites, particularly blood sugar levels, in unexercised fish could prove useful as a rapid method for measuring toxicity of pulpmill effluents and other pollutants.

75-000266 McNicholl, P. G.; Mackay, W. C. (Mackay, W. C.: Dep. Zool., Univ. Alta., Edmonton, AB T6G 2E1, Can.) EFFECT OF DDT AND M.S. 222 ON LEARNING A SIMPLE CONDITIONED RESPONSE IN RAINBOW TROUT (/SALMO GAIRDNERI/). J. Fish. Res. Board Can. 32 (5): 661-665. May 1975. In English With French summ. SFA 20(3).

Rainbow trout (/Salmo gairdneri/) were force fed, with and without M.S. 222 anesthesia, pellets containing DDT equivalent to 0, 10, and 100 percent of the 96 h-LD50 dose of 0.03 mg DDT/g body weight. DDT at the LD50 dose significantly increased learning rate 48 and 72 h after treatment. Although the 10 percent LD50 group did not learn significantly faster than controls, their slightly improved learning rate indicated a dose-dependent response curve. M.S. 222 did not affect learning rate of a simple conditioned response whether or not the anesthetic was combined with DDT.

75-000267 McNicholl, P. G.; Mackay, W. C. (Mackay, W. C.: Dep. Zool., Univ. Alta., Edmonton, Alta. T6G 2E1, Can.) EFFECT OF DDT ON DISCRIMINATING ABILITY OF RAINBOW TROUT (/SALMO GAIRDNERI/). J. Fish. Res. Board Can. 32 (6): 785-788. June 1975. In English with French summ. SFA 20(3).

Rainbow trout (/Salmo gairdneri/) trained to discriminate between a bright (773 lx) and a dim (22 lx) light were tested to determine the minimum difference in light intensity they could distinguish before and 71 h after being given DDT orally at 0, 30, 50, and 80 percent of the LD50 dose. Discriminating ability decreased linearly with increased dose, while performance and retention were unaffected.

75-000268 Meyer, F. L., Jr.; Mehrle, P. M., Jr.; Dwyer, W. P. (Fish-Pesticide Res. Lab., U.S. FWS, Columbia, MO 65201) TOXAPHENE EFFECTS ON REPRODUCTION, GROWTH, AND MORTALITY OF BROOK TROUT. U.S. EPA, Ecol. Res. Ser. EPA-600/3-75-013. viii + 43p. Nov. 1975. SFA 20(3).

Yearling brook trout (/Salvelinus fontinalis/) were continuously exposed to toxaphene (0, 39, 68, 139, 288, and 502 ng/l) in a flow-through diluter system. Day length and water temperature were altered monthly to correspond to natural conditions. Adult growth was reduced in the 288 and 502 ng/l toxaphene exposures, and the added stress of spawning activities caused extensive mortalities in these concentrations. The numbers of eggs spawned and percent viability were inversely related to increasing toxaphene concentrations. All groups of fry exposed to toxaphene had reduced rates of growth and survival. Biochemical investigations on fry backbones demonstrated that bone collagen may be a sensitive indicator of normal and abnormal growth and development prior to being observed in the whole fish. Toxaphene was accumulated by brook trout 5,000 to 76,000 times that in the water and the more chlorinated isomers of toxaphene were preferentially stored.

75-000269 Murray, D. A. J. (Dep. Environ., Freshwater Inst. Winnipeg, MB R3T 2N6, Can.) ANALYSIS OF TRI-ARYL PHOSPHATE ESTERS AND THE DETERMINATION OF IMOL S-140 IN FISH TISSUE AND WATER SAMPLES BY GAS CHROMATOGRAPHY. J. Fish. Res. Board Can. 32 (4): 457-460. Apr. 1975. In English with French summ. SFA 20(3).

This report describes a method for the analysis of tri-aryl phosphate esters used commericially as lubricants. In a fish toxicity study, Imol S-140 (tri-tolyl phosphate) was extracted from fish tissue and water samples, hydrolyzed, and the individual phenols measured by gas chromatography as the trimethylsilyl derivatives. The lower detection limit was about 3 ppm of Imol in wet fish tissue.

75-000270 Neves, R. J. (Me. Coop. Fish. Unit., Univ. Me., Orono 04473) ZOOPLANKTON RECOLONIZATION OF A LAKE COVE TREATED WITH ROTENONE. Trans. Am. Fish. Soc. 104 (2): 390-393. Apr. 1975. SFA 20(3).

The application of rotenone to a 4.5-hectare cove of South Branch Lake, Maine, greatly reduced the abundances of most zooplankton species. The recolonization of the cove by limnetic zooplankters was rapid, and species abundances there approached those of open waters and of the control cove within one week.

75-000271 Niimi, A. J.; LaHam, Q. N., (Dep. Biol., Univ. Ottawa, Ottawa, Ont. K1N 6N5, Can.) SELENIUM TOXICITY ON THE EARLY LIFE STAGES OF ZEBRAFISH (/BRACHYDANIO RERIO/). J. Fish. Res. Board Can. 32 (6): 803-806. June 1975. In English with French summ. SFA 20(3).

Embryos at four stages of development and the newly hatched larvae of zebrafish (/Brachydanio rerio/) were exposed to selenium concentrations between 0.5 and 10 ug/ml to establish the toxic levels at the different stages. Embryo mortality was negligible at all selenium concentrations. Following hatching, mortality among the larvae sharply increased at concentrations of 3 ug/ml or greater irrespective of the embryonic stage when exposed. For most treatments, over 90 percent of the larvae died within 10 days of hatching. The mortality rate for larvae exposed to selenium after hatching was slightly less.

75-000272 Pisapia, R.; Kopyta, F.; Keller, E. C., Jr. (Dep. Biol., W.Va. Univ., Morgantown 26506) /CHLORELLA VULGARIS/ GROWTH RESPONSE TO ACID MINE WATER STRESS UNDER CONDITIONS OF CONSTANT AND REDUCED LIGHT. Proc. W.Va. Acad. Sci. 45 (2): 120-127. 1973. SFA 20(3).

Axenic cultures of /Chlorella vulgaris/ (Pratt strain) were grown at ambient temperature using a modified Beijerinck's media and four concentrations of acid mine water (0/32, 1/32, 2/32, 3/32) in a light and a predominantly dark environment. Cell counts were made using an electronic particle counter. From these data, four growth parameters were estimated: 1) the maximum specific growth rate, r(m); 2) the maximum population growth rate, popK; 3) the average time for the population to reach the maximum growth rate, G-50, and 4) the maximum number of cells obtained, Nmax.

The maximum specific growth rate was shown to differ significantly between the effects of the light conditions and the level of acid mine water (AMW) concentration. Most of the significant variability among the four AMW concentrations for this parameter was attributable to those cultures grown in continuous light.

The difference between the light and reduced light conditions had a significant effect on the time measure of the lag phase of growth. For those cultures grown in the reduced light environment, the different concentrations of AMW showed no significant effect on the four growth parameters measured.

75-000273 Renfro, W. C.; Fowler, S. W.; Heyraud, M.; La Rosa, J. (Northeast Util. Co., Hartford, CT 06101) RELATIVE IMPORTANCE OF FOOD AND WATER IN LONG-TERM ZINC-65 ACCUMULATION BY MARINE BIOTA. J. Fish. Res. Board Can. 32 (8): 1339-1345. Aug. 1975. In English with French summ. SFA 20(3).

Shrimp, crabs, and fish were maintained for 3 mo in a ^{65}Zn-labeled simulated ecosystem in which individuals were allowed to accumulate the radiotracer either directly from the water or from a combined food and water pathway. Shrimp and crabs, receiving ^{65}Zn from the food-water milieu, did not attain significantly higher ^{65}Zn body burdens than those individuals that accumulated the isotope from water only. For fish, the food pathway accounted for only 2.5 times more ^{65}Zn than that obtained after direct accumulation from water. Specific activity measurements of both organisms and water as well as comparisons of radioactive concentration factors with those based on stable element measurements indicated that ^{65}Zn in organisms had not reached isotopic equilibrium with the isotope in the water, even though net ^{65}Zn accumulation in shrimp and crabs had ceased by the end of the experiment. It was concluded that there are zinc pools within adult organisms that exchange only slowly, if at all, with zinc atoms available in the organisms' food or surrounding water. Hence, aquatic organisms such as those used in this study can most likely achieve

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true isotopic equilibrium only after living significant portions of their actively growing life stages in a radioactive environment.

75-000274 Richardson, L. B.; Burton, D. T.; Margrey, S. L. (Acad. Nat. Sci. Phila., Benedict Estuarine Res. Lab., Benedict, MD 20612) A RESPIROMETER TECHNIQUE FOR EVALUATING THE POTENTIAL EFFECTS OF RAPID THERMAL CHANGES TO SMALL AQUATIC ORGANISMS. Prog. Fish-Cult. 37 (1): 57-59. Jan. 1975. SFA 20(3).

A 20-channel Gilson differential respirometer has been modified to evaluate potential physiolcgical adjustments of small aquatic animals exposed to time-temperature histories. Although the system was designed for thermal entrainment studies, the versatility of the apparatus is such that many temperature increase and decay schemes can be reproduced with relative ease. (RS)

75-000275 Schroeder, G. L. (Fish Aqua-culture Res. Sta., Dor, Israel) EFFECT OF BROMEX-50 ON PLANKTON POPULATION IN FISH PONDS. Bamidgeh 27 (1): 3-7. Mar. 1975. SFA 20(3).

Four fish ponds were treated with Bromex-50 which is used for the eradication of the ectoparasite /Lernaea/. Plankton concentrations, dissolved oxygen (DO) and pH were monitored prior to and following the application of Bromex-50 to the ponds. In moderately stocked ponds, the standing crop of zooplankton decreased from 0.8 mg dry weight per liter prior to the Bromex to less than 0.05 mg per liter, twelve hours after the application of Bromex. In heavily stocked ponds the decrease was from 0.1 mg per liter to less than 0.05 mg per liter. Analysis of the pond water twelve hours after the Bromex treatment revealed no zooplankton activity. At plus two days zooplankton activity was observed to have returned and at plus seven to nine days the zooplankton concentrations were similar to the pre Bromex values. No changes related to Bromex were observed in phytoplanktcn standing stocks, pH or DO.

75-000276 Skinner, W. F.; Keller, E. C., Jr. (Dep. Biol., W.Va. Univ., Morgantown 26506) THE GROWTH OF /CHLORELLA VULGARIS/ IN SEWAGE AND ACID MINE WATER. Proc. W.Va. Acad. Sci. 44 (1): 49-56. 1972. SFA 20(3).

Preliminary research has been conducted to determine the effects of sewage, acid mine water (AMW), and their interaction on the growth of the unicellular green alga /Chlorella vulgaris/ Beijerinck (Pratt strain). The nutrient media were composed of sterile synthetic sewage and/or acid mine water diluted to the desired concentrations with a standard inorganic culture medium (modified Beijerinck's medium). Six concentrations of sewage (0/0, 1/32, 1/16, 1/8, 1/4, 1/2), four concentrations of AMW (0/0, 1/32, 1/16, 1/8), alone and in all possible combinations were evaluated. The cultures were grown at 25 C in 24x150 mm glass culture tubes, aerated, and agitated with sterile humidified air, and illuminated from below by approximately 500 f.c. light intensity by "Gro-lux" fluorescent tubes. The maximum growth was obtained with the 1/2 sewage treatment, the least amount of growth occurred in the 1/8 AMW + 1/2 sewage treatment. /Chlorella vulgaris/ was apparently able to utilize some of the components in the sewage since better growth occurred in all treatments containing only sewage than in the control. However, high concentrations of sewage in combination with high concentrations of AMW inhibited algal growth.

75-000277 Smith, T. G.; Armstrong, F. A. J. (Dep. Environ., Arctic Biol. Sta., Ste. Anne de Bellevue, Que. H9X 3L6, Can.) MERCURY IN SEALS, TERRESTRIAL CARNIVORES, AND PRINCIPAL FOOD ITEMS OF THE INUIT, FROM HOLMAN, N.W.T. J. Fish. Res. Board Can. 32 (6): 795-801. June 1975. In English with French summ. SFA 20(3).

Total mercury analyses were made on liver and muscle of ringed and bearded seals, of caribou, and on muscle of Arctic char (the principal items in the diet of local people), of Arctic fox and sledge dogs (which feed mostly on ringed seal) and on wolves (predacious on caribou). About half of the 123 samples were also analyzed for methyl mercury, and some for selenium.

Ringed seals showed mean total mercury levels of 27 ppm in lever and 0.73 in muscle. Bearded seals showed 143 in liver and 0.53 in muscle. In the livers, methyl mercury was a small fraction of the total, being 5.6 percent in ringed and 0.38 percent in bearded seals. There were positive and significant correlations of mercury content with age and body weight. In Arctic char, mean total mercury was 0.049 ppm, and in caribou 0.20 in liver and 0.017 in muscle. In Arctic fox, values for liver and muscle were 0.77 and 0.32, and in sledge dogs 11.5 and 0.79 ppm.

Seals form only part of the diet of the local people. Blood mercury levels have been reported for this community as being above average though not dangerously so. A change in diet, such as increased consumption of seals, might change this.

75-000278 Tarter, D. C.; Woodrum, J. E. (Dep. Biol. Sci., Marshall Univ., Huntington, WV 25701) LOW PH TOLERANCE OF THE LARVAE OF THE ALDERFLY, /SIALIS AEQUALIS/ BANKS, UNDER CONTROLLED CONDITIONS. Proc. W.Va. Acad. Sci. 44 (1): 85-88. 1972.

The larval population of the alderfly, /Sialis aequalis/ Banks, was experimentally tested in the laboratory to determine its tolerance to low pH. The straight-line graphical interpolation method was employed to determine the pH value at which 50 per cent of the alderflies survived after 96 hours. The $TL(m)^{96}$ pH value was 2.1.

75-000279 Voyer, R. A. (EPA, P.O. Box 277, West Kingston, RI 02892) EFFECT OF DISSOLVED OXYGEN CONCENTRATION ON THE ACUTE TOXICITY OF CADMIUM TO THE MUMMICHOG, /FUNDULUS HETEROCLITUS/ (L.), AT VARIOUS SALINITIES. Trans. Am. Fish. Soc. 104 (1): 129-134. Jan. 1975. SFA 20(3).

The effect of dissolved oxygen (DO) concentration on acute toxicity of cadmium to the mummichog, /Fundulus heteroclitus/ (L.), at selected salinities was studied. Fish were acclimated to either test salinities (10, 20, 32 °/oo) up or to 32 °/oo and then exposed at 10 and 20 °/oo. Levels of DO between 4 mg/liter and saturation did not significantly influence the tolerance of fish to cadmium poisoning in 96 hours, regardless of salinity and acclimation regime.

75-000280 Wagemann, R.; Graham, B.; Lockhart, W. L. (Inquiries to: Res. Dev. Dir., Freshwater Inst., Winnipeg, MB, Can.) STUDIES ON CHEMICAL DEGREDATION AND FISH TOXICITY OF A SYNTHETIC TRI-ARYL-PHOSPHATE LUBRICATION OIL, IMOL S-140. Environ. Can., Fish. Mar. Serv., Res. Dev. Dir., Tech. Rep. No. 486. iv + 30p. 1974. In English with French summ. SFA 20(3).

The toxicity of tri-aryl phosphates to humans and animals, and accidental poisonings with such substances are reviewed.

The toxicity of a commercial, synthetic tri-aryl phosphate lubricating oil, IMOL S-140, to rainbow trout, and the rate of hydrolysis of this substance were investigated. An approximate hydrolysis rate constant of 9 x 10 to the minus 3/days, and a half-

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life of 96 days for IMOL in fresh water were obtained. The contribution of phosphate to a natural water body from hydrolysis of IMOL is compared with the natural phosphate input from a watershed.

IMOL in water was not acutely toxic to rainbow trout, but prolonged exposure at concentrations of 0.3-0.9 mg/l of IMOL in water had an adverse effect on fish. In a four-month exposure period normal feeding was progressively impaired to the extent that towards the end of this period fish began to die. Enlarged livers, hardened fatty tissue, and a bluish discoloration of fatty tissue were observed in necropsied fish exposed to IMOL. The enzymes lactate dehydrogenase and glutamic oxalacetic transaminase were significantly higher in blood serum of fish exposed to IMOL compared with levels in unexposed fish.

FISH TOXICANTS

75-000281 Dawson, V. K.; Cumming, K. B.; Gilderhus, P. A. (Fish Contr. Lab., La Crosse, WI 54601) LABORATORY EFFICACY OF 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM) AS A LAMPRICIDE. U.S. Fish Wildl. Serv., Invest. Fish Contr. 63. 13p. 1975. SFA 20(3).

The lampricidal activity of 3-trifluoromethyl-4-nitrophenol (TFM) was tested under controlled laboratory conditions to evaluate factors which may influence the efficacy of the chemical. TFM was tested at temperatures of 7, 12, 17, and 22 C, total water hardnesses of 12, 44, 170, and 300 mg/l as CaCO(3), and pH's of 6.5, 7.5, 8.5, and 9.0. TFM is an effective lampricide. It is more effective against larvae of the sea lamprey (/Petromyzon marinus/) than against embryos and prolarval stages and slightly more effective against larvae of sea lampreys than against those of the American brook lamprey (/Lampetra lamottei/). Efficacy of the lampricide is affected very little by temperature, but is reduced in hard water, especially at high pH's. High pH decreases the activity of TFM and has the greatest influence on toxicity of any of the factors investigated. TFM is significantly more effective against exposed (free-swimming) larvae than against those in burrows.

75-000282 Gilderhus, P. A.; Sills, J. B.; Allen, J. L. (Fish Contr. Lab., La Crosse, WI) RESIDUES OF 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM) IN A STREAM ECOSYSTEM AFTER TREATMENT FOR CONTROL OF SEA LAMPREYS. U.S. Fish Wildl. Serv., Invest. Fish Contr. 66. 7p. 1975. SFA 20(3).

Samples of water, bottom soil, plants, invertebrates, and fish for residue analysis were collected from two stations on the East Au Gres River in Michigan before, during, and after treatment of the stream with 3-trifluoromethyl-4-nitrophenol (TFM) for control of sea lampreys (/Petromyzon marinus/). The residues were highest in samples collected as the last portion of full-strength TFM flowed past each station, and were much higher in water and organisms than in the bottom soil. Fish retained higher residues than other organisms 24 h after treatment (up to 6 ug/g); however, the residues decreased to less than 0.08 ug/g at 96 h after treatment. Residues in soil were among the lowest found in all samples collected during the study.

75-000283 Marking, L. L. (Fish Contr. Lab., LaCrosse, WI 54601) EFFECTS OF PH ON TOXICITY OF ANTIMYCIN TO FISH. J. Fish. Res. Board Can. 32 (6): 769-773. June 1975. In English with French summ. SFA 20(3).

Detoxification of antimycin at pH 9.5 was caused by two factors. The piscicide was biologically unavailable at the high pH, and this unavailability was reversed by decreasing the pH of water solutions. Simultaneously antimycin detoxified with time, and the resulting loss in toxicity was irreversible. The toxicity of antimycin was related to the amount of un-ionized molecules; however, the dissociation curve resulting from the published pKa of 5.1 does not agree with the implied dissociation when based on toxicity. Toxicity of antimycin decreased gradually from pH 6.5 to 8.5 and abruptly from 8.5 to 9.5 with carp (/Cyprinus carpio/), green sunfish (/Lepomis cyanellus/), and bluegill (/Lepomis macrochirus/). As previously suggested, water hardness had little or no effect on toxicity.

75-000284 Mehrle, P. M.; Mayer, F. L., Jr. (U.S. FWS, Fish-Pesticide Res. Lab., Columbia, MO 65201) TOXAPHENE EFFECTS ON GROWTH AND DEVELOPMENT OF BROOK TROUT /SALVELINUS FONTINALIS/. J. Fish. Res. Board Can. 32 (5): 609-613. May 1975. In English with French summ. SFA 20(3).

Twenty-two days before hatching, eyed eggs of brook trout /Salvelinus fontinalis/ were placed in a flow-through system and continuously exposed to toxaphene (0, 39, 68, 139, 288, and 502 ng/liter) until they hatched and the resulting fry were exposed for a further 90 days. Hatchibility was not affected by toxaphene, but all of the fry exposed to 502 and 288 ng/liter of toxaphene died by 30 and 60 days after hatch, respectively. Growth of fry was significantly depressed at the 139 and 288 ng/liter concentrations 30 days after hatch and at all concentrations after 60 and 90 days of toxaphene exposure.

Whole body collagen of fry, as estimated by hydroxyproline, was significantly decreased in the four higher concentrations of toxaphene within 7-15 days after hatch. Backbone collagen was significantly decreased (P less than 0.05) in 30-, 60-, and 90-day-old fry exposed to toxaphene, whereas calcium and phosphorus concentrations in the backbone were increased (P less than 0.05). The mineral:collagen ratio was significantly increased by toxaphene. The whole body collagen of sac-fry was a good predictor of later growth and development of brook trout.

75-000285 Mehrle, P. M.; Mayer, F. L., Jr. (U.S. FWS, Fish-Pesticide Res. Lab., Columbia, MO 65201) TOXAPHENE EFFECTS ON GROWTH AND BONE COMPOSITION OF FATHEAD MINNOWS, /PIMEPHALES PROMELAS/. J. Fish. Res. Board Can. 32 (5): 593-598. May 1975. In English with French summ. SFA 20(3).

Fathead minnows (/Pimephales promelas/) were exposed to toxaphene (55-1230 ng/liter) in a flow-through diluter system for 150 days. Growth was not affected by toxaphene for up to 90 days of exposure, but within 150 days it was significantly reduced at all concentrations. Collagen content of the backbone was decreased (P less than 0.05), amino acid composition was changed, and calcium concentration was increased. Results from this study suggest that toxaphene altered the development and quality of the backbone, and induced biochemical manifestations of the "broken-back" syndrome. Radiographic analyses of the fish support our hypothesis that toxaphene induced a weakened, fragile backbone.

75-000286 Piavis, G. W.; Howell, J. H. (Dep. Anat., Sch. Dent., Univ. Md., Baltimore 21201) EFFECTS OF 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM) ON DEVELOPMENTAL STAGES OF THE SEA LAMPREY. U.S. Fish Wildl. Serv., Invest. Fish. Contr. 64. 8p. 1975. SFA 20(3).

Developing sea lampreys (/Petromyzon marinus/) in stages 1 (zygote) through 17 (burrowing prolarva) were exposed for 24 h to a 10-mg/l (active ingredient) solution of 3-trifluoromethyl-4-nitrophenol (TFM) at 18 C. Embryonic development, incidence of abnormalities, and mortality in the experimentals were compared with those in unexposed control. Although exposed embryos in the first eight developmental stages exhibited no immediate effects, the number of viable stage-18 larvae produced was drastically reduced, incidence of abnormalities increased markedly, hatching was sometimes delayed, and hemoglobin production was retarded or lacking. The laboratory findings suggest that the treatment of streams with TFM at the customary rates probably does not effect a complete kill of sea lampreys in all developmental stages.

75-000287 Sills, J. B.; Allen, J. L. (Southeast Fish. Contr. Lab., Warm Springs, GA) ACCUMULATION AND LOSS OF RESIDUES OF 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM) IN FISH MUSCLE TISSUE: LABORATORY STUDIES. U.S. Fish Wildl. Serv., Invest. Fish Contr. 65. 10p. 1975. SFA 20(3).

Residues of 3-trifluoromethyl-4-nitrophenol (TFM) in muscle tissue of eight species of fish, after they were exposed under controlled conditions, were determined by gas chromatography. The mean concentration of TFM residue in samples from various species immediately after a 12-h exposure to 1 to 4 mg/l of TFM ranged from 0.02 to 5.09 ug/g depending on pH, temperature, hardness of the test solutions, and TFM concentrations. Residues decreased rapidly after the fish were withdrawn from the test media, and were near the limit of detection (0.01 ug/g) within 24 h.

75-000288 Statham, C. N.; Lech, J. J. (Dep. Pharmacol., Med. Coll. Wis., Milwaukee, WI 53233) METABOLISM OF 2',5-DICHLORO-4'-NITROSALICYLANILIDE (BAYER 73) IN RAINBOW TROUT (/SALMO GAIRDNERI/). J. Fish. Res. Board Can. 32 (4): 515-522. Apr. 1975. In English with French summ. SFA 20(3).

Uptake metabolism, and elimination of 2',5-dichloro-4'-nitrosalicylanilide (Bayer 73) was studied in rainbow trout (/Salmo gairdneri/) exposed to ^{14}C Bayer 73 in water. Transfer of trout to fresh water after exposure to Bayer 73 for 12 h resulted in the disappearance of ^{14}C from most tissues after 48-72 h. A 24-h ^{14}C bile to water ratio of 10,000:1 indicated a high degree of biliary concentration. A single polar ^{14}C metabolite was purified from bile. Analysis by analytical thin-layer chromatography, beta-glucuronidase hydrolysis, acid hydrolysis, infrared spectroscopy, and mass spectrometry indicated that the material was the glucuronide conjugate of Bayer 73.

75-000289 Watkins, W. D.; Tarter, D. C. (Dep. Biol. Sci., Marshall Univ., Huntington, WV 25701) ACUTE TOXICITY OF ROTENONE ON THE NAIADAL STAGE OF THE DRAGONFLY, /BASIAESCHNA JANATA/ SAY, UNDER LABORATORY CONDITIONS. Proc. W.Va. Acad. Sci. 46 (2): 141-145. 1974. SFA 20(3).

The acute toxicity of rotenone on the naiadal stage of the dragonfly, /Basiaeschna janata/ Say, was tested under laboratory conditions. A straight-line graphical interpolation method was used to determine the concentration of rotenone at which 50 percent of the naiads survived after 96 hours ($TL(m)^{96}$). The lethal concentration of

75-000289 CONTINUED
rotenone was 0.22 mg/L.

RESEARCH AND MANAGEMENT-GENERAL

75-000290 Lackey, R. T. (VPI & SU, Blacksburg 24061) TEACHING WATER RESOURCE MANAGEMENT WITH THE AID OF A COMPUTER-IMPLEMENTED SIMULATOR. Va. Water Resour. Res. Cent., VPI & SU, Bull. 78. iii + 98p. Mar. 1975. SFA 20(3).

Computer-implemented learning exercises involving large system management should become an important natural resource educational tool. DAM illustrates the principles of managing a large multiple-use reservoir system. Stages in the development of DAM were: (1) model conceptualization; (2) model quantification and implementation; and (3) model refinement. The finished product is based on the use of economic and quantity numerical accumulators and a random number generating function. Management realism and role switching enhance DAM's value as a tool for acquainting students with management based on total system understanding.

75-000291 Wiener, J. G.; Fuller, S. E. (Savannah River Ecol. Lab., Drawer E, Aiken, SC 29801) COMMENTS ON "ENVIRONMENTAL EVALUATION BASED ON RELATIVE GROWTH RATES OF FISHES." Prog. Fish-Cult. 37 (2): 99-100. Apr. 1975. SFA 20(3).

Utilization of information on growth rates of fishes for environmental assessment of aquatic habitats has two inherent weaknesses. First, considerable variation in growth rates can occur among populations of a species even in the absence of environmental differences. Growth rates of fishes are often greatly dependent upon population density. Second, species of fish frequently respond differently to the same environmental perturbation (e.g., nutrient enrichment). Hence, conclusions derived from investigations of relative growth rates of a single species may apply only to a small group of ecologically similar species.

The study of community structure utilizing diversity indices provides a more reliable means for the biological assessment of environmental quality in aquatic systems.

REPORTS OF FISHERY STATIONS, STATES, ETC.

75-000292 Ricker, W. E. (Dep. Environ., Pacific Biol. Sta., Nanaimo, B.C. V9R 5K6, Can.) THE FISHERIES RESEARCH BOARD OF CANADA -- SEVENTY-FIVE YEARS OF ACHIEVEMENTS. J. Fish. Res. Board Can. 32 (8): 1465-1490. Aug. 1975. In English with French summ. SFA 20(3).

The idea of having government research supervised by a group of knowledgeable individuals outside of the government service began, in Canada, in the field of aquatic science and fisheries. In 1898 an honorary Board of Management was set up to establish and manage a biological station on the Atlantic coast. As this Board's responsibilities increased it was renamed the Biological Board of Canada, and finally the Fisheries Research Board of Canada. Starting in 1973 the Board ceased to have direct responsibility for the management of research stations, but it continues as an advisory body.

During the period 1898-1972 the Board has provided facilities for original research on aquatic animals and plants and on the waters they inhabit, much of it done by scientists from universities and museums; it has solved many problems faced by governments in locating,

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evaluating, managing and increasing fish stocks; and it has assisted the fishing industry with improved techniques for catching, handling, processing and marketing its products. The immediately useful results of the Board's work have been made available to the Canadian community through reports, publicity and personal contacts. Details of scientific discoveries have been published in the Board's /Journal/ and other outlets, while results of research done in other countries have been sifted and interpreted for their application to the Canadian scene.

75-000293 Sarig, S. (Lab Res. Fish Diseases, Nir-David, Israel) FISHERIES AND FISH CULTURE IN ISRAEL IN 1974. Bamidgeh 27 (2): 25-39. June 1975. SFA 20(3).

1. The total catch of the Israeli fisheries in 1974 was 22,185 tons, a drop of 11 percent compared with 1973.
2. Imports of filleted, frozen and other fish products increased by 425 tons (5.6 percent) compared with 1973.
3. The annual per-capita consumption decreased by 10 percent from the 10-year average of 10.0 kg to 9.0 kg.
4. The portion of pondfish in the per-capita consumption decreased from 4.3 kg in 1973 to 3.8 kg which is from 43.0 percent to 41.0 percent of the total consumption.
5. The marine catch decreased by 18 percent compared with 1973.
6. The Lake Kinneret catch decreased by 5 percent compared with 1973.
7. Deep-sea fishing decreased by 671 tons (13 percent) compared with 1973.
8. The total marketed fish pond production decreased by 1617 tons (12 percent) and amounted to 12,675 tons, instead of 14,033 tons in 1973.
9. The average yield per ha of marketable pond fish was 2520 kg/ha, which is 360 kg/ha (12.5 percent) less than in 1973.
10. In 42 farms out of 81, the average yield per ha on an area of 2526 ha varied between 2.5 to over 3.5 tons.
11. Fourteen farms on an area of 614.4 ha reached an average yield of 3990 kg/ha. Two of these farms obtained yields of 5590 and 6580 kg/ha.
12. The proportion of carp in the pond fish total went down to 76 percent from 83 percent in 1973. Tilapia increased from 8 percent to 13 percent, and silver carp from 5 percent to 8 percent.

75-000294 U.S. Dep. Commerce (NMFS, Sci. Publ. Staff, 1107 N.E. 45th St., Seattle, WA 98105) REPORT OF THE NATIONAL MARINE FISHERIES SERVICE FOR THE CALENDAR YEAR 1974. U.S. Dep. Commerce, NOAA, NMFS, Washington, D.C. 50p. July 1975. SFA 20(3).

This report, required by Section 9(a) of the Fish and Wildlife Act of 1956, as amended 16 U.S.C. 742h(a), covers calendar year 1974.

It describes (1) the state of the U.S. fisheries in calendar year 1974, (2) the present organization of the National Marine Fisheries Service (NMFS), and (3) significant developments. It also lists the publications pertinent to its goals and activities during that year. (Auth. Intro.)

HABITAT ALTERATION

75-000295 Bustard, D. R.; Narver, D. W. (B. C. Fish. Wildl. Br., Smithers, BC, Can.) PREFERENCES OF JUVENILE COHO SALMON (/ONCORHYNCHUS KISUTCH/) AND CUTTHROAT TROUT (/SALMO CLARKI/) RELATIVE TO SIMULATED ALTERATION OF WINTER HABITAT. J. Fish. Res. Board Can. 32 (5): 681-687. May 1975. In English with French summ. SFA 20(3).

Winter habitat preferences of juvelile coho salmon (/Oncorhynchus kisutch/) and cutthroat trout (/Salmo clarki/) were tested by simulating conditions before and after stream disturbance such as might result from logging: (1) sidepools with or without an overhanging bank and roots, and (2) sidepools with clean or silted rubble substrate. Both coho and cutthroat demonstrated a strong preference for sidepools offering overhanging bank cover as opposed to those without bank cover. Similarly they preferred sidepools with clean rubble substrate as opposed to silted rubble. In both the bank and rubble tests, when given the option of either remaining in the sidepools or of moving into the stream, a greater percentage of the total number of coho and cutthroat originally in the sidepools remained in the pools with cover as opposed to those without cover. Coho utilized bank cover more readily than rubble cover whereas cutthroat used both bank and rubble cover.

75-000296 Dewees, C. M.; Gotshall, D. W. (Coop. Ext., Univ. Calif., Davis 95616) AN EXPERIMENTAL ARTIFICIAL REEF IN HUMBOLDT BAY, CALIFORNIA. Calif. Fish Game 60 (3): 109-127. July 1974. SFA 20(3).

In October 1968, an artificial reef constructed of used truck tires was placed in Southport Channel of Humboldt Bay, California, by the Eureka Kiwanis Club. Studies were conducted to determine floral and faunal species composition and relative abundance, and to measure fishing success on the reef.

A "rocky habitat fish fauna" was attracted to the reef. Between April 13, 1969, and May 13, 1970, 15 species were captured by hook and line. Seven species were tagged with Petersen disc tags. Estimates of fish populations revealed that the most abundant fishes were kelp greenling, followed by copper and black rockfish. No tagged fish were captured away from the reef. The reef did not attract large fish from other reef areas. Nearly all fish captured on the reef during spring, 1969, were of the 1968 year class. During dives, 9 species of fish, 25 species of invertebrates and 3 species of algae were observed on or near the reef. Lingcod and pile perch were the only species of fish observed by divers but not captured by hook and line.

Fishing success was measured to better understand the effectiveness of the reef. The most successful fishing was from May to October. During periods of extremely turbid water or heavy tidal currents, fishing success tended to decrease.

75-000297 Ringler, N. H.; Hall, J. D. (Sch. Nat. Resour., Univ. Mich., Ann Arbor 48104) EFFECTS OF LOGGING ON WATER TEMPERATURE AND DISSOLVED OXYGEN IN SPAWNING BEDS. Trans. Am. Fish. Soc. 104 (1): 111-121. Jan. 1975. SFA 20(3).

The temperature and dissolved oxygen content of intragravel water were measured in three Oregon coastal streams between June 1968 and June 1969. In 1966, the watershed of one stream had been completely clearcut, and that of a second stream partially clearcut in staggered settings. A third watershed was left unlogged.

Clearcut logging resulted in increased temperature of intragravel water in salmon and trout spawning beds and decreased concentrations of dissolved oxygen. The changes were related largely tc reduced

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forest cover over the stream surface and to deposition of fine sediment in the gravel.

No serious reduction in survival to emergence of coho salmon occurred along with the observed changes in temperature or dissolved oxygen. A decrease in the resident population of cutthroat trout after logging may have been related to these changes.

75-000298 Vogele, L. E.; Rainwater, W. C. (S. Cent. Reservoir Invest., U.S. FWS, Fayetteville, AR 72701) USE OF BRUSH SHELTERS AS COVER BY SPAWNING BLACK BASSES (/MICROPTERUS/) IN BULL SHOALS RESERVOIR. Tran. Am. Fish. Soc. 104 (2): 264-269. Apr. 1975. SFA 20(3).

Brush shelters were placed along alternate 100-m shoreline sections in two coves, and examined underwater weekly, for 7 weeks during the spawning season, to compare the use of sheltered and unsheltered habitat for nesting by three speciesd of bass--largemouth (/Micropterus salmoides/), spotted (/M. punctulatus/), and smallmouth (/M. dolomieui/).

Spotted bass consistently preferred the sheltered habitat; largemouth bass were most selective for sheltered segments early in the spawning season during their most intensive nesting period. Smallmouth bass showed no preference for the brush shelters as nesting sites.

HARVEST, CREEL CENSUS

75-000299 Falk, M. R.; Gillman, D. V.; Dahlke, L. W. (Dep. Environ., Fish. Manage. Div., Winnipeg, Man., Can.) 1974 CREEL CENSUS DATA FROM SPORT FISHING LODGES ON GREAT BEAR AND GREAT SLAVE LAKES, NORTHWEST TERRITORIES. Dep. Environ., Fish. Mar. Serv., Fish. Oper. Dir., Cent. Reg., Data Rep. Ser. No. CEN/D-75-3. vi + 26p. 1975. SFA 20(3).

From June to September, 1974, a creel census and sampling program was carried out at five sport fishing lodges on Great Bear and Great Slave lakes. This was done as part of a continuing study (Falk et al., MS 1973 and MS 1974) designed to monitor the harvest of lake trout (/Salvelinus namaycush/) from these lakes; to determine the effects of past and present levels of exploitation on the fish populations; and to recommend remedial action if necessary. The objectives of the present study were to determine if reduced catch and possession limits implemented prior to the 1974 season were effective in reducing the harvest of lake trout; to further define the effects of exploitation on the fish populations; and to explore the natural history of lake trout in order to manage the species more effectively on a biological basis.

Data from the creel census segment of the 1974 study are presented here pending completion of biological analysis. When complete, the report will cover the results of the three-year investigation in detail and will present recommendations for management direction and future studies. (Auth. Intro.)

75-000300 Klauda, R. J.; Campbell, K. P.; Cooper, W. E., Jr. (Texas Instruments Inc., P.O. Box 237, Buchanan, NY 10511) THE STRIPED BASS COMMERCIAL FISHERY OF THE HUDSON RIVER. Presented at the Hudson River Ecol. Soc. Meeting, Saratoga, NY. 12p. 11 June 1975. SFA 20(3).

Commercial catch and fishing effort data for the Hudson River were analyzed for the period from 1931 through 1972 to assess the range of variability in stock size and to evaluate evidence of density dependent population regulation. Fishing effort appeared to vary in response to economic rather than biological conditions. Relative abundance of striped bass fluctuated at relatively low levels from 1931 through 1953, increased sharply in 1955 to a peak in 1960, declined to 1964 and peaked again in 1969. Possible effects of regulatory and gear changes in the fishery on catch/effort values were discussed. A graph of catch/effort against catch/effort five years later closely approximated a Ricker stock-recruitment curve. The Hudson River striped bass population appears to be regulated by density-dependent factors, with competition or cannibalism as possible mechanisms.

75-000301 Pearcy, W. G.; Panshin D. A.; Keene, D. F. (Sch. Oceanogr., Oregon State Univ., Corvallis 97331) CATCHES OF ALBACORE AT DIFFERENT TIMES OF THE DAY. NOAA Fish. Bull. 73 (3): 691-693. July 1975. SFA 20(3).

Catch rates for albacore were not constant with time of day, but consistant trends for diel periodicity were apparent. Relatively low catch rates during the day may result either from albacore pursuing saury into deeper water where albacore are less vulnerable to fishing, or to reduced feeding activity. (RS)

75-000302 Priegel, G. R.; Wirth, T. L. (Wis. Dep. Nat. Resour., Rt. 4, Madison 53711) LAKE STURGEON HARVEST, GROWTH, AND RECRUITMENT IN LAKE WINNEBAGO, WISCONSIN. Wis. Dep. Nat. Resour., Tech. Bull. No. 83. 25p. 1975. SFA 20(3).

The harvest, age structure, and estimated recruitment of the lake sturgeon population in Lake Winnebago was determined through a registration system from 1955 through 1969. The average annual harvest during this period was 599 fish. Extreme fluctuations in the annual harvest are governed by weather conditions and water clarity and not by scarcity of legal-sized fish. Neither a continuous sport fishery in effect since 1932 nor an unknown harvest by illegal methods has resulted in a rapid decline in the fishery as far as can be determined to date.

The sturgeon population in Lake Winnebago to date has demonstrated little decline in the average age and size of fish harvested and in the catch per unit of effort.

The standing crop of lake sturgeon over 40 inches in Lake Winnebago is probably no more than 11,500. Because of unknown harvest by illegal methods, 4.7 percent (recruitment) or 540 fish is the maximum segment of the legal population that can safely be taken annually if the population present in 1969 is to be maintained.

75-000303 Sunada, J. S. (Calif. Dep. Fish Game, Sacramento 95814) AGE AND LENGTH COMPOSITION OF NORTHERN ANCHOVIES, /ENGRAULIS MORDAX/, IN THE 1972-73 SEASON CALIFORNIA ANCHOVY REDUCTION FISHERY. Calif. Fish Game 61 (3): 133-143. July 1975. SFA 20(3).

A total of 68,510 metric tons (75,519 short tons) of anchovies was caught in the California reduction fishery during the 1972-73 season. Data analysis indicated a dominance of age-group II (1970 year class) with large numbers of age-group I in southern California. Central California anchovy age composition was dominated by age-groups III and IV.

75-000304 Talbot, G. B.; Wares, P. G. (Southeast Reservoir Invest., U.S. FWS, Clemson, SC 29631) FISHERY FOR PACIFIC BILLFISH OFF SOUTHERN CALIFORNIA AND MEXICO, 1903-69. Trans. Am. Fish. Soc. 104 (1): 1-12. Jan. 1975. SFA 20(3).

Sport fishing for striped marlin (/Tetrapturus audax/) began off southern California in 1903. Catches of this species have fluctuated widely. Some of the annual variation in catch (15 percent to 25 percent) may be attibutable to variations in water temperatures. When the marlin season ends in southern California, usually in November, some fishermen who own yachts begin fishing for billfish in Mexican waters, particularly near Cabo San Lucas and La Paz, Baja California. This fishing is restricted to winter and spring because of severe tropical storms which occur in the summer, and lack of protective harbors except at La Paz.

Access by land or air to good billfishing in Mexico became available in 1936 at Guaymas, in 1949 at Acapulco and La Paz, in 1958 at Mazatlan, and at several locations between La Paz and Cabo San Lucas shortly thereafter. Fishing for billfish in Mexico now accounts for an estimated expenditure annually of about $10 million by United States citizens, and is the major business in lower Baja California.

While sport fishing facilities were being developed in Mexico, the Japanese moved their longline fishery eastward in search of better fishing grounds. They first fished in eastern Pacific waters in 1956, and gradually increased their fishing effort to a peak in 1969. This increase in effort produced lower catches and lower catches per unit of effort than previously had been made for the three species of marlin (/T. audax; Makaira nigricans; M. indica/) and Pacific sailfish (/Istiophorus platypterus/) found in Mexican Pacific waters. The decline of the fishery and the decrease in the average weight of striped marlin since commercial longline fishing began indicates that overfishing is probably occurring. Sport fishing for billfish in Mexico is now much less spectacular than in the 1930's to the 1950's but still is better than in most other areas. If further reduction in abundance occurs, international cooperation should be undertaken to maintain these populations at a level where they will concurrently support productive sport and commercial fisheries.

REGULATIONS

75-000305 Falk, M. R.; Gillman, D. V. (Dep. Environ., Fish. Manage. Div., Winnipeg, Man., Can.) MORTALITY DATA FOR ANGLED ARCTIC GRAYLING AND NORTHERN PIKE FROM THE GREAT SLAVE LAKE AREA, NORTHWEST TERRITORIES. Dep. Environ., Fish. Mar. Serv., Fish. Oper. Dir., Cent. Reg., Data Rep. Ser. No. CEN/D-75-1. v + 24p. 1975. SFA 20(3).

In 1973 a study was carried out on Great Slave and Great Bear lakes to determine the extent of hooking mortality among lure caught lake trout (/Salvelinus namaycush/) and to compare the effects of barbed and barbless treble hooks on trout survival (Falk et al. 1974). In

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conjunction with and following this study, additional attention was directed towards Arctic grayling (/Thymallus arcticus/) and northern pike (/Esox lucius/) for the same purposes. These species are also prized by anglers in the Great Slave Lake area and undergo a substantial release rate (Falk et al. MS 1973; MS 1974-a).

Results of the study on Arctic grayling and northern pike are presented in this report to provide data on which possible regulation changes such as mandatory barbless hooks, fly-fishing only restriction or minimum size limits may be based. The results are of particular interest in view of the recommendation of a minimum size limit for Arctic grayling proposed in the Brabant Island area by Falk and Gillman (MS 1974). (Auth. Intro.)

FISH CONTROL AND REMOVAL

75-000306 Cumming, K. B.; Burress, R. M.; Gilderhus, P. A. (U.S. FWS, Fish Contr. Lab., La Crosse, WI) CONTROLLING GRASS CARP (/CTENOPHARYNGODON IDELLA/) WITH ANTIMYCIN, ROTENONE, AND THANITE AND BY ELECTROFISHING. Prog. Fish-Cult. 37 (2): 81-84. Apr. 1975. SFA 20(3).

Two piscicides (antimycin and rotenone), an experimental sedative chemical (Thanite), and electrofishing were evaluated as controls against grass carp (/Ctenopharyngodon idella/) in 0.04- to 1.4-ha ponds. All sizes of grass carp exposed were killed by either 6 ug/l of antimycin or 2 mg/l of 5 percent rotenone. Antimycin was selective against grass carp in experimental and production ponds that contained channel catfish. Grass carp were successfully collected alive with Thanite and with electrofishing gear (both 230-volt, 3-phase AC and 110-volt DC).

MARKING AND TAGGING

75-000307 Avtalion, R. R.; Weiss, E. (Dep. Life Sci., Bar-Ilan Univ., Ramat-Gan, Israel) A METHOD FOR INDIVIDUAL MARKING OF FISH. Bamidgeh 27 (1): 21-22. Mar. 1975. SFA 20(3).

Tilapia and carp were successfully marked under laboratory conditions by using a tag originally developed for the textile industry. Perforation of tag edges provided a code to identify individual fish. (RS)

75-000308 Hager, B. (Wash. Dep. Fish., Olympia 98504) A TECHNIQUE FOR THE MASS RECOVERY OF CODED WIRE TAGS FROM YOUNG SALMONIDS. Prog. Fish-Cult. 37 (1): 51. Jan. 1975. SFA 20(3).

75-000309 Hart, L. G.; Summerfelt, R. C. (Rt. 1, Box 65, Goodview, VA 24095) SURGICAL PROCEDURES FOR IMPLANTING ULTRASONIC TRANSMITTERS INTO FLATHEAD CATFISH (/PYLODICTIS OLIVARIS/). Trans. Am. Fish. Soc. 104 (1): 56-59. Jan. 1975. SFA 20(3).

Ultrasonic transmitters were surgically implanted into the peritoneal cavity of anesthetized flathead catfish through an incision made along the linea alba. The incision was closed with a single row of sutures through the peritoneum and dermis. Postoperative care included holding the fish in water with 50 mg/liter of oxytetracycline for 48-72 hours. After obtaining surgical experience, neither survival nor growth appeared to be affected by the surgery or by the presence

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of the transmitter. Flathead catfish with ultrasonic transmitters were tracked intermittently for as long as 40 days in Lake Carl Blackwell, Oklahoma. Behavior appeared to be normal after an initial adjustment period of about 36 hours, during which time movements seemed excessive. The same procedure was also used successfully on largemouth bass and striped bass.

75-000310 Leary, D. F.; Murphy, G. I. (Hawaii Inst. Mar. Biol., Univ. Hawaii, Honolulu 96822) A SUCCESSFUL METHOD FOR TAGGING THE SMALL, FRAGILE ENGRAULID, /STOLEPHORUS PURPUREUS/. Trans. Am. Fish. Soc. 104 (1): 53-55. Jan. 1975. SFA 20(3).
Survival of anchovies (/Stolephorus purpureus/), held in tanks for 30 days after being tagged with a tiny wire implanted automatically by a new device, was 80.5 percent and tag loss 14.7 percent. Both criteria were superior to those reported for engraulids tagged by other methods. Advantages of the new tag are small size, internal location, ease of implantation, and capability of being detected automatically.

75-000311 McCleave, J. D.; Stred, K. A. (Dep. Zool., Univ. Me., Orono 04473) EFFECT OF DUMMY TELEMETRY TRANSMITTERS ON STAMINA OF ATLANTIC SALMON (/SALMO SALAR/) SMOLTS. J. Fish. Res. Board Can. 32 (4): 559-563. Apr. 1975. In English with French summ. SFA 20(3).
Effects of three different-sized, internally placed dummy ultrasonic transmitters and one size externally placed dummy radic transmitter on swimming performance of Atlantic salmon (/Salmo salar/) smolts were determined. Critical swimming speeds were similar for fish in control groups and two of the groups tagged with internal transmitters. The widest internal dummy tag (19 mm long X 10 mm diameter) caused a significant (P less than 0.05) decrement in swimming performance; the size representing the smallest available transmitters (33 mm long X 8 mm diameter) did not. Linear regression analysis of this latter group demonstrated that larger smolts carried the transmitter better than smaller smolts. Results indicated that fish longer than about 20 cm can successfully be tagged with the available transmitter. Externally placed dummy radio transmitters caused a highly significant (P less than 0.01) decrease in swimming speed compared with that cf controls.

STOCKING AND INTRODUCTIONS

75-000312 Avery, E. L. (Wis. Dep. Nat. Resour., Waupaca 54981) AN EVALUATION OF STOCKING FINGERLING TROUT IN A "TWO-STORY" TROUT LAKE. Wis. Dep. Nat. Resour., Res. Rep. No. 83. 4p. June 1975. SFA 20(3).
On 31 May 1973, 4,500 brown trout and 4,500 rainbow trout fingerlings were stocked in Nebish Lake. Trout ranged from 3.0 to 4.2 inches in total length. Large smallmouth bass captured in fyke nets set in early June 1973 were satiated and regurgitated half a dozen fingerling trout during handling. Only 1 brown trout was captured during fyke netting and electrofishing conducted in the spring and fall of both 1973 and 1974. Survival of fingerling trout was essentially nil after 5-1/2 months in Nebish Lake. Total angler harvest consisted of 1 rainbow trout caught by an ice fisherman in January 1975. Growth of the trout which survived in Nebish Lake was excellent.
Stocking fingerling trout 3-4 inches in length in a "two-story" lake containing smallmouth bass and an abundant, slow-growing yellow perch population is not recommended because of the high probability of poor trout survival due, at least in part, to fish predatiсn. (Auth. Summ.)

75-000313 Bryson, W. T.; Lackey, R. T.; Cairns, J., Jr.; Dickson, K. L. (Dep. Fish. Wildl. Sci., VPI & SU, Blacksburg, VA 24061) RESTOCKING AFTER FISHKILLS AS A FISHERIES MANAGEMENT STRATEGY. Trans. Am. Fish. Soc. 104 (2): 256-263. Apr. 1975. SFA 20(3).

Research on stocking the New River with channel catfish (/Ictalurus punctatus/) following a partial fishkill showed restocking to be unsuccessful and of no measurable benefit to the fishery. Only an estimated 50 of the 3,000 channel catfish stocked were recovered by anglers. Cost of each recovered fish was $18.00, based on the initial stocking cost. Factors contributing to the failure of the restocking program probably include the considerable time between the fishkill and restocking (16 months), natural repopulation from unaffected areas, and the relatively small size of the "catchable" stocked fish. A survey of state fisheries agencies (43 replies) regarding restocking policy following a fishkill showed that: (1) twenty states do not restock as a normal policy; (2) fourteen states said they did not restock following fishkills; (3) twenty-seven state agencies replied that they had methods for economic evaluation of fishkills (ranging from a constant price per pound or number, regardless of species, to the Southern Division, American Fisheries Society, method which gives costs per inch and/or per pound of a species or family); and (4) a consensus existed that no detailed evaluation of the effectiveness of restocking after fishkills has been made.

75-000314 Forney, J. L. (Dep. Nat. Resour., Cornell Univ., Ithaca, NY 14850) CONTRIBUTION OF STOCKED FRY TO WALLEYE FRY POPULATIONS IN NEW YORK LAKES. Prog. Fish-Cult. 37 (1): 20-24. Jan. 1975. SFA 20(3).

Ten lakes were stocked with walleye fry in alternate years and the density of fry was estimated at intervals after stocking. Densities were substantially higher in years when fry were released, although most lakes supported established adult populations of walleyes. Limited reproductive success suggests that supplemental stocking may have broader application than generally assumed.

75-000315 Rawstron, R. R. (Calif. Dep. Fish Game, Sacramento 95814) MORTALITY AND GROWTH RATES, COST, AND RELATIVE CONTRIBUTION OF TWO DIFFERENT SIZES OF SILVER SALMON STOCKED IN LAKE BERRYESSA, CALIFORNIA, IN 1972. Calif. Fish Game 61 (3): 127-132. July 1975. SFA 20(3).

Tagged silver salmon stocked in Lake Berryessa, Napa County, California, showed nearly identical mean annual exploitation and survival rates, 0.38 and 0.18 when compared to 1970 and 1971 experiments. Total harvest (0.46) was slightly higher. Growth ultimately achieved in this experiment amounted to 1.65 kg (3.64 lb) after approximately 18 months in the lake and showed an increase of 0.23 kg (0.50 lb) over 1971. Cost to the angler's creel ($1.53/kg) also increased, but resulted from increased hatchery production costs. Anglers caught 213.1 percent of the originally planted weight, consistent with previous findings. Fish planted in March contributed equally to the catch and confirmed previous findings that silver salmon under certain conditions can be planted at a smaller size or earlier in the year than rainbow trout and still make a valuable contribution to a limnetic fishery. Their role and criteria for selection in a given water are also discussed.

FISHING GEAR AND TECHNIQUES

75-000316 Beard, T. D.; Priegel, G. R. (Wis. Dep. Nat. Resour., Spooner 54801) CONSTRUCTION AND USE OF A 1-FOOT FYKE NET. Prog. Fish-Cult. 37 (1): 43-46. Jan. 1975. SFA 20(3).

A method was needed to capture enough fingerling bluegills in a short time period to make population estimates. A 1-ft, small mesh fyke net was constructed which has been very effective in capturing bluegill fingerlings. It also shows promise for capturing young fish of other species. A white net has been the most effective to date in the small, clear-water lakes sampled as compared to black or dark-colored nets. Construction details and material list are included in the report.

75-000317 Hocutt, C. H.; Hambrick P. S.; Masnik, M. T. (VPI & SU, Blacksburg, VA 24061) ROTENONE METHODS IN A LARGE RIVER SYSTEM. Arch. Hydrobiol. 72 (2): 245-252 July 1973. SFA 20(3).

The use of rotenone, block net, and potassium permanganate proved to be an effective method for sampling fishes in a large river system. Methods developed were responsible for establishing nine distributional records of fishes in the main-channel New River, including the addition of three species (/Cottus b. bairdi/, /Etheostoma caeruleum/ and /Etheostoma osburni/) to the known fauna. Rotenone resulted in higher numbers of species and specimens collected per locality than by seining. Analyses of the data revealed consistently higher diversity indexes (SUMD) for rotenone collections.

75-000318 Kjelson, M. A.; Turner, W. R.; Johnson, G. N. (NMFS, Atl. Estuarine Fish. Cent., Beaufort, NC 28516) DESCRIPTION OF A STATIONARY DROP-NET FOR ESTIMATING NEKTON ABUNDANCE IN SHALLOW WATERS. Trans. Am. Fish. Soc. 104 (1): 46-49. Jan. 1975. SFA 20(3).

A 4 m^2 stationary drop-net capable of sampling the entire column of water in depths up to 1 m is described. The net is a modified purse seine constructed of 3-mm nylon mesh with top enclosed and hung from a frame 1 m above the surface. The net is dropped when support pins are released via a trip line from the shore. In 25 paired trials, the haul seine, with its greater area of coverage per haul (525 m^2), captured more species than the drop-net, but the drop-net yielded estimates of a signigicantly higher density for fish and macrocrustaceans by individual species.

75-000319 Priegel, G. R.; Novotny, D. W. (Wis. Dep. Nat. Resour., Madison 53711) A SIMPLE ELECTRICAL FILTER TO IMPROVE ELECTROFISHING. Prog. Fish-Cult. 37 (2): 118. Apr. 1975. SFA 20(3).

One factor that reduces the efficiency of a direct current electrofishing system is the high frequence ripple in the generator output. This can occur in generators that produce alternating current and convert to direct current electronically. A simple electrical filter was designed to remove the ripple.

75-000320 Schott, J. W. (Calif. Dep. Fish Game, Sacramento 95814) OTTER TRAWL COD-END ESCAPEMENT EXPERIMENTS FOR CALIFORNIA HALIBUT. Calif. Fish Game 61 (2): 82-94. Apr. 1975. SFA 20(3).

Two otter trawl cod-end escapement experiments were conducted to test escapement of sub-legal unmarketable California halibut (/Paralichthys californicus/) through large and small meshed cod ends. Most sub-legal halibut (less than 22 inches TL) escaped through the 7 1/2-inch mesh cod end. Fewer halibut of higher average weight, but with greater total weight, were captured by the 7 1/2-inch mesh cod end, than by the cod ends of smaller mesh size.

75-000321 South Dakota Dep. Game Fish Parks (Pierre, SD 57501) SOUTH DAKOTA ANGLERS ALMANAC. S.D. Dep. Game Fish Parks, Pierre 35p. 1975. SFA 20(3).

75-000322 Sutterlin, A. M. (Dep. Environ., Biol. Sta., St. Andrews, N.B. E0G 2X0, Can.) CHEMICAL ATTRACTION OF SOME MARINE FISH IN THEIR NATURAL HABITAT. J. Fish. Res. Board Can. 32 (6): 729-738. June 1975. In English with French summ. SFA 20(3).

Using underwater television, photography, and fish traps the attractiveness of a number of natural bits and pure compounds to four species of marine fish was examined directly in their natural habitat. Winter flounders (/Pseudopleuronectes americanus/), mummichog (/Fundulus heteroclitus/), and Atlantic silversides (/Menidia menidia/) were each attracted by specific amino acids. Only flounders and killifish exhibited biting and digging behavior in the vicinity of the odor source. Hagfish (/Myxine glutinosa/) could be trapped using a variety of natural baits but no single amino acid or a variety of combinations of amino acids or amines was effective. The active principle(s) in cod muscle accounting for its attractiveness to hagfish was found to be heat stable, of small molecular weight and extractable with ethanol. Chromatographic separation of the ethanol extract resulted in only one active fraction consisting of several compounds. This fraction, however, accounted for only a small amount of the total activity in the ethanol extract, suggesting a multicomponent system.

FERTILIZATION OF WATER AND SOIL

75-000323 Arce, R. G.; Boyd, C. E. (Cent. Luzon State Univ., Nueva Ecija, Philippines) EFFECTS OF AGRICULTURAL LIMESTONE ON WATER CHEMISTRY, PHYTOPLANKTON PRODUCTIVITY, AND FISH PRODUCTION IN SOFT WATER PONDS. Trans. Am. Fish. Soc. 104 (2) 308-312. Apr. 1975. SFA 20(3).

Five ponds treated with agricultural limestone and five control ponds were stocked with /Tilapia aurea/ and fertilized every 2 weeks with ammonium nitrate and triple superphosphate. Initially, total hardness and total alkalinity of the waters in the 10 ponds averaged 7.8 and 13.7 mg/liter, respectively. Liming caused a fourfold increase in total hardness and total alkalinity. Limed ponds had higher rates of phytoplankton productivity and yielded a 25 percent greater weight of fish than control ponds.

75-000324 Menendez, R. (W.Va. Dep. Nat. Resour., P.O. Box 67, Elkins 26241) RESULTS OF TWO YEARS OF CREEL CENSUS ON OTTER CREEK, A NATURALLY ACID STREAM TREATED WITH LIMESTONE. Proc. W.Va. Acad. Sci. 46 (2): 155-158. 1974. SFA 20(3).

Following limestone treatment to neutralize the acidity, the brook trout population in Otter Creek increased dramatically. By 1971 the trout population had increased to the point where angling could be allowed.

The stream was opened to angling in 1971 to fly fishing only during a June 1-September 12 season. During 1971 an estimated 227 anglers fished 553 hours and caught 1166 trout at the rate of 2.1/hr. Of these fish 216 were kept. During 1972 an estimated 183 anglers fished 871 hours and caught 868 trout at the rate of 1.12/hr. One hundred sixty-three trout were kept.

FISHWAYS, FISH PASSAGE THROUGH DAMS, ETC.

75-000325 Grimes, C. B. (Inst. Mar. Sci., Univ. N.C., Morehead City 28557) ENTRAPMENT OF FISHES ON INTAKE WATER SCREENS AT A STEAM ELECTRIC GENERATING STATION. Chesapeake Sci. 16 (3): 172-177. Sept. 1975. SFA 20 (3).

To investigate entrapment of fishes, traveling intake water screens were sampled monthly in 1969 and 1970 at a steam electric power station near Crystal River, Florida. Samples contained 73 species representing 41 families; the majority of individuals were juveniles or weak-swimming species. There was an inverse relationship between intake water temperature and catch. Highest mortalities occurred with the first cold temperatures of winter and later with lowest water temperatures. Comparison of catch-per-unit-effort during daylight and darkness in 1970 showed monthly catch-per-hour for dark sampling approximately equal to or greater than for light. Greatest disparities between day and night sampling occurred simultaneously with coldest water temperatures.

75-000326 Liscom, K. L; Volz, C. D. (NMFS, Northwest Fish. Cent., Seattle, WA 98112) IMPEDANCE BRIDGE FISH COUNTER. Prog. Fish-Cult. 37 (1): 39-42. Jan. 1975. SFA 20(3).

An automatic fish counter was tested at Ice Harbor Dam on the Snake River in Washington for enumerating juvenile Pacific salmon (/Oncorhynchus/ spp.) and steelhead trout (/Salmo gairdneri/) passing through gatewell orifices.

75-000327 Menchen, R. S. (Calif. Dep. Fish and Game, Sacramento 95819) PERFORATED PIPE USED TO SCREEN AND TRAP JUVENILE SALMONIDS. Prog. Fish-Cult. 37 (2): 85-89. Apr. 1975. SFA 20(3).

The use of perforated pipe to screen and trap juvenile salmonids in a relatively unsilted gravel stream is described. Two projects are discussed: One is a fish screen to prevent fish from entering irrigation diversions which divert from 20 to 60 ft^3/S, and the other is an algae trap to prevent plugging of an inclined plane screen to aid in capturing downstream migrant salmon. The advantages of using perforated pipe are ease in construction and very low maintenance costs. After more than 3 years of continual operation, the technique has been highly successful.

75-000328 Muessig, P. H.; Mayercek, D. R.; Grove, T. L. (Texas Instruments Inc., Ecol. Serv., P.O. Box 237, Buchanan, NY 10511) THE INTERACTION OF NATURAL HISTORY AND ENVIROMENTAL VARIABLES AS INFLUENCING FACTORS IN THE IMPINGEMENT OF FISH. Presented at the 105th Annu. Meeting, Am. Fish. Soc., Las Vegas, Nev. 10-13 Sept. 1975. Abstract only. SFA 20(3).

An impingement monitoring program has been ongoing at the Consolidated Edison of New York Indian Point Nuclear Generating Plants since 1969. Impinged fish were collected from the intake screens daily, identified, and enumerated. Throughout the study plant and environmental data have been collected in an attempt to identify the major sources of variation in impingement rates. Simultaneous field studies have provided information on the natural history and population dynamics of fish species vulnerable to impingement.

Distribution, abundance, and life history of anadromous and resident fish species influenced vulnerability to impingement and determined the composition of impingement collections. The Hudson River estuary serves as a spawning and nursery area for several anadromous fishes and the young of those species made up the largest part of impingement collections. The interrelationships of natural history and environmental factors influenced magnitude of impingement. Salinity regimes influenced distribution and abundance of fishes and impingement peaks corresponded to salt wedge intrusions. Temperature and salinity influenced physiological state and effected vulnerability to impingement. Nocturnal activity patterns resulted in daily impingement peaks.

Assessment of impingement impact and evaluation of solutions are dependant upon an understanding of these behavioral and physiological interactions and the life history of the fish populations in the esturay. A well designed ongoing monitoring program is necessary to identify factors influencing impingement and allow empirical evaluation of impact and solutions.

75-000329 Snyder, D. E. (Ecol. Sci. Div., NUS Corp., 2419 Baldwick Rd., Pittsburg, PA 15205) PASSAGE OF FISH EGGS AND YOUNG THROUGH A PUMPED STORAGE GENERATING STATION. J. Fish. Res. Board Can. 32 (8): 1259-1266. Aug. 1975. In English with French summ. SFA 20(3).

During June and July 1970, an estimated 5.3 million eggs (4.1/10 and 56.6 million young fish (43.8/10 , 3-62 mm FL, were pumped by the Muddy Run Pumped Storage Generating Station from Conowingo Reservoir (lower Susquehanna River, Pennsylvania) into Muddy Run Pumped Storage Reservoir. A maximum of only 2 percent of the eggs and 39 percent of the young were returned to the lower reservoir during generation. The eggs were predominately /Carpoides cyprinus/. Of the young, 73 percent entrained during pumping and 83 percent entrained during generating were /Ictalurus punctatus/, /Cyprinus carpio/, and /Carpiodes cyprinus/. Similar results are reported for 1969. The species and numbers of specimens entrained reflect the utilization of the area near and above the lower reservoir intake discharge structure as spawning and nursery grounds, the extent and peaks of spawning seasons, and the phases of development and behavior of the young. Sufficient numbers of specimens pumped into and retained by the upper reservoir, in which natural reproduction is nearly precluded by the extensive fluctuation of water level, survive to maintain many of the reservoir's fish populations.

MATHEMATICS, STATISTICAL METHODS AND MODELING

75-000330 Jolicoeur, P. (Dep. Sci. Biol., Univ. Montreal, Montreal, Que., Can.) LINEAR REGRESSIONS IN FISHERY RESEARCH: SOME COMMENTS. J. Fish. Res. Board Can. 32 (8): 1491-1494. Aug. 1975. In English with French summ. SFA 20(3).

When a statistical relationship has to be described between two variates that are both subject to errors or fluctuations, the /standard major axis/, advocated recently in this journal under the name /GM regression/, is unsuitable. The /ordinary major axis/ or, even better, the /bivariate structural relationship/, which includes the ordinary major axis as a special case, should be preferred.

75-000331 Ricker, W. E. (3052 Hammond Bay Rd., Nanaimo, B. C., Can.) A NOTE CONCERNING PROFESSOR JOLICOEUR'S COMMENTS. J. Fish. Res. Board Can. 32 (8): 1494-1498. Aug. 1975. In English with French summ. SFA 20(3).

The ordinary major axis of a bivariate normal distribution is unsuitable for describing the functional relationship (in Lindley's general sense) between two naturally variable quantities, because it is not invariant with scale and because qualitatively unlike quantities are subtracted in computing it. The bivariate structural relationship is unsuitable because one of the parameters required, lambda, cannot be estimated from naturally variable data; in fact lambda has no objective meaning for such data. The standard major axis (or GM regression line) has neither of these defects, and it is the line that minimizes the sum of products of the absolute vertical and horizontal deviations of data points from itself.

75-000332 Ricker, W. E. (Dep. Environ. Pacific Biol. Sta., Nanaimo, B.C. V9R 5K6, Can.) COMPUTATION AND INTERPRETATION OF BIOLOGICAL STATISTICS OF FISH POPULATIONS. Bull. Fish. Res. Board Can. 191. xviii + 382p. 1975. SFA 20(3).

This bulletin is the author's third that deals with the general field of biological statistics of fish populations. The earlier ones date from 1948 and 1958, respectively, and both are long out of print. The present work began as a revision of the 1958 text, but so many changes, additions, and deletions proved desirable that it has become in many respects a new work. Even so, the text does not attempt to include all the developments in this field in recent years. The general plan and arrangement of materials is similar to that of the 1958 Bulletin, but it proved impossible to indicate which passeges are new and which are quotations from the earlier volumes. However, where Examples are repeated this has been indicated. Methods which seem conceptually similar are presented in the same chapter, proceeding from the simpler to the more complex as far as possible. Some attention is given also to the historical development of each topic, and this will be considered in somewhat greater detail elsewhere. The amount of space that each topic receives varies with its importance and with its availability. Procedures described in standard western journals are not, as a rule, given detailed development: usually only the formulae most useful for estimating population statistics are quoted, and a discussion of sampling error and of the conditions which make them usable. More extended treatment is given to methods taken from obscure sources and new developments or new aspects of existing methods. This plan does not give ideal balance, but it does perhaps make for maximum usefulness within a limited compass. (From Auth. Preface.)

75-000333 Walter, G.; Hoagman, W. J. (Dep. Math., Univ. Wis., Milwaukee 53201) A METHOD FOR ESTIMATING YEAR CLASS STRENGTH FROM ABUNDANCE DATA WITH APPLICATION TO THE FISHERY OF GREEN BAY, LAKE MICHIGAN. Trans. Am. Fish. Soc. 104 (2): 245-255. Apr. 1975. SFA 20(3).

A method of calculating indices of annual year class strength from abundance data only is introcuced. It involves a mathematical technique based on difference equations. The method is applied to data for six commercially harvested species of Green Bay, Lake Michigan. Estimated year class strengths are then compared with relative abundance indices of the parental spawning populations. Only for smelt and perch was there a significant correlation between the two. The same species were also the only ones for which the expcnential relation of Ricker between spawners and year class strengths could be established.

LAKE MANAGEMENT & RESEARCH

75-000334 Barica, J. (Dep. Environ., Freshwater Inst., Winnipeg, Man. R3T 2N6, Can.) SUMMERKILL RISK IN PRAIRIE PONDS AND POSSIBILITIES OF ITS PREDICTION. J. Fish. Res. Board Can. 32 (8): 1283-1288. Aug. 1975. In English with French summ. SFA 20(3).

Summer fish kills in shallow, landlocked ponds of the Erickson-Elphinstone area, southwestern Manitoba, were caused by collapses of heavy algal blooms, mostly /Alphanizomenon flos-aquae/, and subsequent oxygen depletion. Kills occurred only in ponds that were in the specific conductance range of 800-2000 umho-cm and where chlorophyll /a/ concentrations exceeded 100 ug/liter. A practical rating system for assessment of summerkill risk was suggested. Correlations between various parameters from 51 ponds were computed; the best ccrrelation ($r = 0.866$; P = greater than 0.99) was found between the late-winter concentration of ammonia nitrogen and the maximum concentration of chlorophyll /a/ in the following summer. Two summerkill prediction systems were proposed, based on ammonia, dissolved oxygen, and Secchi disc transparency, enabling the prediction of summerkill risk 9 or 3 mo prior to stocking of the fish.

75-000335 Smith, S. A.; Knauer, D. R.; Wirth, T. L. (Wis. Dep. Nat. Resour., Box 450, Madison 53701) AERATION AS A LAKE MANAGEMENT TECHNIQUE. Wis. Dep. Nat. Resour., Tech. Bull. No. 87. 42p. 1975. SFA 20(3).

The objective of this project was to demonstrate the feasibility of hypolimnetic aeration as a useful technique for lake restoration. In order to successfully evaluate hypolimnetic aeration, aerators were installed in two eutrophic lakes in central Wisconsin. The major component of the hypolimnetic aerator consisted of a 40-ft long, 18-inch diameter polyethylene tube with an internal longitudinal plate dividing the tube in half and twisted to form a helix. Compressed air or a combination of compressed air and liquid oxygen were supplied to the base of the unit and water was air lifted up the tube to enter a 4-ft by 4-ft by 8-ft bubble separation box at the surface of the lake, where the air bubbles were vented to the atmosphere. The bubble-free oxygenated water was returned to the hypolimnion via two 18-inch diameter flexible return tubes. An evaluation of the unit was completed in a eutrophic, clear, hard water lake (Mirror) in 1972 and 1973 and in a dystrophic soft water lake (Larson) in 1973. The initial studies indicated that all of the oxygen transfer from the compressor occurred in the bottom half of the unit, with further transfer

75-000335 CONTINUED
occurring in the surface separation box as the water momentarily came in contact with the atmosphere.

Under operationg conditions at Mirror Lake with an air supply of 16 cfm and a water flow moving through the aerator at 4.2 cfs, the dissolved oxygen transfer efficiency of the entire unit (including oxygen transfer in the separation box) was 20 percent. A combination of compressed air at 16 cfm and liquid oxygen at 5.5 cfm was supplied to the aerator giving a water flow of 5.3 cfs and an oxygen transfer efficiency of 23 percent. The oxygen transfer efficiency at Larson Lake with compressed air only was between 12 and 14 percent.

Both Mirror and Larson lakes had anoxic hypolimnia during the summer months. Attempts at satisfying the very high oxygen demands in Mirror Lake (maximum biological oxygen demand in the bottom water was 39 mg/l before aeration) were unsucessful during limited aeration in 1972 and extended operation in 1973. However, the operation of the aerator in Larson Lake proved successful. Dissolved oxygen concentrations in the hypolimnion increased from 0.0 to 7.0 mg/l. At present, establishment of a cold water fishery appears possible in Larson Lake and current research has indicated a trout population can be maintained in the hypolimnion.

RIVER AND STREAM MANAGEMENT & RESEARCH

75-000336 Flick, W. A.; Webster, D. A. (Dep. Nat. Resour., N.Y. State Coll. Agri. Life Sci., Cornell Univ., Ithaca, NY 14853) MOVEMENT, GROWTH, AND SURVIVAL IN A STREAM POPULATION OF WILD BROOK TROUT (/SALVELINUS FONTINALIS/) DURING A PERIOD OF REMOVAL OF NON-TROUT SPECIES. J. Fish. Res. Board Can. 32 (8): 1359-1367. Aug. 1975. In English with French summ. SFA 20(3).

No well-defined changes in growth and survival rates of native brook trout (/Salvelinus fontinalis/) were detected during a 13-yr period when non-trout species were removed from a small Adirondack Mountain stream using fixed traps located throughout the system. The catch of non-trout species was about 124,000 weighing 2000 kg, and of trout, 13,000, weighing 500 kg. Slow growth characterized the population through this time, with mean lengths of 13.2, 17.3, and 21.3 cm at ages I+, II+, and III+, respectively. The weighted annual survival rate for ages II-V was 18 percent, with most deaths due to natural causes. The most striking observation was virtual cessation of movement of both trout and non-trout species after 7 yr, suggesting that the removal program had an effect on population behavior, even if it was not reflected in an improvement in trout growth.

75-000337 Funk, J. L. (Mo. Dep. Conserv., Fish Wildl. Res. Cent., Columbia 65201) THE FISHERY OF GASCONADE RIVER, MISSOURI. Mo. Dep. Conserv., Aquatic Ser. No. 13. 26p. 1975. SFA 20(3).

The fish population of the main stem of the Gasconade River was sampled three times annually, 1947-1957, at four stations using an electric shocker, hoop nets, and drag seines. The Gasconade watershed is in the Ozark Highland zoogeographical area. Stream flow was substantially below normal 1953-1956, due to drought. The stream supports a good population and fishery for smallmouth bass although its gradient (average, 4 ft/mi) is lower than in most good smallmouth streams. Ninety-eight species of fish have been collected in the Gasconade watershed with species characteristic of the Ozarks predominating. Six species are on the Missouri rare and endangered species list but none is on the national list. In terms of biomass the principal species of larger fish (more than 1/2 ounce) were: golden redhorse, black redhorse, rock bass, flathead catfish, channel

75-000337 CONTINUED
catfish, carp, smallmouth bass, gizzard shad, hogsucker, longear sunfish, largemouth bass, shorthead redhorse, freshwater drum, green sunfish, river redhorse, and bluegill. Electric shocker catch rates by season were highest in the fall, lowest in the spring. By station, the lowest rates were at the lower station, the highest at No. 4 with the middle and upper stations intermediate. Annual electric shocker catch rates fell into two groups, a low group, 1947-1949, and a higher group, 1950-1953. The hoop nets were especially effective in taking catfish, rockbass and sunfish. Hoop net catch rates in summer were much higher than in spring or fall. The highest annual hoop net catch rates occurred 1948-1950. Drag seine catch rates added little significant information.

Growth of rock bass, smallmouth bass, and carp in the Gasconade River exceeded the averages used for comparison. Hogsuckers, redhorse suckers, largemouth bass, longear sunfish, and bluegill grew at average or better rates. Growth of gizzard shad, green sunfish, and freshwater drum generally was below average. Spawning and survival was very successful in 1952 for smallmouth bass, redhorse suckers, hogsuckers, rock bass, and certain minnow species, apparently due to low, stable water conditions in this first year of the drought.

Seventy-one species of forage fish (less than 1/2 ounce) were collected and species characteristic of the Ozarks predominated. The bleeding shiner, rosy-faced shiner, stoneroller, bluntnose minnow, spotfin shiner, wedgespot shiner, and longear sunfish were abundant at all stations and made up nearly 60 percent of all forage fish collected. The stations differed in the composition of the forage fish populations.

The general creel census indicates that fishing in the upper Gasconade was somewhat better and in the lower Gasconade somewhat poorer than in the Ozark Highland Area as a whole. Species which were abundant in the fish population predominated in the catch. Creel census results suggest that the Gasconade watershed, exclusive of the Big Piney River, might support 115,000 fishing trips (485,000 man hours) and a harvest of 267,000 fish annually. (From Auth. Abstr.)

75-000338 Schoumacher, R. (1404 Robertson St., Ft. Collins, CO 80521) SOME OBSERVATIONS ON CHANNEL CATFISH POPULATIONS IN THE OHIO RIVER BORDERING WEST VIRGINIA. Proc. W.Va. Acad. Sci. 45 (2): 136-145. 1973. SFA 20(3).

Fish population sampling was carried on from 1966 to 1969 to determine the feasibility of establishing a commercial fishery in the Ohio River. A total of 24,028 fish, including 19,451 channel catfish, were taken with oak catfish traps and hoop nets. Numerous other fish were taken with other nets and toxicants. Channel catfish growth and condition factors were judged average when compared to other areas. Populations of this species suitable to support a commercial fishery were found in much of the Ohio.

75-000339 Soldwedel, R. H. (New Jersey Dep. Environ. Prot., Freshwater Fish. Lab., Lebanon, NJ) DEVELOPMENT OF TROUT MANAGEMENT PRACTICES IN THE SPRUCE RUN RESERVOIR TRIBUTARIES. N.J. Dep. Environ. Prot., Div. Fish. Game Shellfish, Misc. Publ. No. 39. ii + 73p. 1974. SFA 20(3).

Spruce Run Creek and Mulhockaway Creek, two tributaries of Spruce Run Reservoir, located northwest of Clinton, New Jersey served as the sites for an evaluation of the practice of establishing "put-and-take" trout stocking programs in minor streams. Special emphasis was placed on how such programs could be made most efficient and possible alternatives to such programs were proposed where possible.

On the basis of the findings of this report it was recommended that Spruce Run Creek be stocked with rainbow trout and only that species

75-000339 CONTINUED
for it appeared that there existed inter-specific competition when other salmonids were introduced or established, which tended to suppress the return of rainbow trout. In view of the tag returns from Mulhockaway Creek and realizing inter-specific competition could not be removed there through stocking practices alone, it was recommended that it be stocked with and /or managed for brown trout.

Only the late in-season release appears to be consistently below the average return.

Holdover trout and the long-term duration of the fishery were considered as relatively insignificant aspects of this program. Streamflow, so important a factor contributing to the loss of stocked trout in major streams, was shown to have relatively little effect on returns in these instances. Turbidity apparently retarded the harvest of trout from Mulhockaway Creek in 1969 and 1971.

The natural reproduction of trout (primarily browns) together with movement of adult trout from the reservoir into the stream was suggestive as capable of supporting a sustained natural, or semi-natural trout fishery, without the aid of stocking, in Mulhockaway Creek, provided restrictive regulations in regard to daily possession limits and size limits were applied.

There was no evidence produced by this study to support the popular contention that the removal of these waters from the "closed" list, thereby permitting immediate angling for the trout following their release, would increase and quicken the return of the stocked trout.

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT

75-000340 Habel, M. L. (Ala. Dep. Conserv. Nat. Resour., Enterprise 36330) OVERWINTERING OF THE CICHLID, /TILAPIA AUREA/, PRODUCES FOURTEEN TONS OF HARVESTABLE SIZE FISH IN A SOUTH ALABAMA BASS-BLUEGILL PUBLIC FISHING LAKE. Prog. Fish-Cult. 37 (1): 31-32. Jan. 1975. SFA 20(3).

In Crenshaw County Lake, the stocking and subsuquent overwintering of /Tilapia aurea/ yielded approximately 527 pounds per acre of harvestable size fish and additionally provided a partial control for the filamentous blue-green algae infestation /Lyngbya/ sp.

75-000341 Nielsen, L. A.; Reynolds, J. B. (Mo. Coop. Fish. Unit., Univ. Mo., Columbia 65201) FRESHWATER SHRIMP-NATURAL FOOD FOR POND FISHES. Farm Pond Harvest 9 (2): 8-9,24. 1975. SFA 20(3).

A fundamental rule of pond management is that a short food chain fosters more efficient sport fish production than a long food chain. The stocking of the freshwater shrimp (/Palaemonetes kadiakensis/), a decapod crustacean, is a promising technique for increasing pond production because (1) shrimp are opportunistic feeders, (2) the entire one-year life cycle is aquatic, (3) shrimp are suitably sized forage for fish like bluegill throughout their life span, and (4) shrimp biomass supplements other forage biomass during critical periods of fish feeding. Bluegill growth in experimental ponds stocked with shrimp was twice as great as in ponds without shrimp. In a natural pond, shrimp occurred in 64 percent of bluegill stomachs and the bluegill exhibited good condition despite the potential for stunted population. The potential utility of shrimp for pond management is illustrated by their broad distribution across the eastern United States and by our success raising shrimp in experimental ponds.

MARINE MANAGEMENT & RESEARCH

75-000342 Shomura, R. S.; Williams, F. (eds.) PROCEEDINGS OF THE INTERNATIONAL BILLFISH SYMPOSIUM KAILUA-KONA, HAWAII, 9-12 AUGUST 1972 PART 1. REPORT OF THE SYMPOSIUM. NOAA Tech. Rep. NMFS SSRF-675. iii + 33p. Mar. 1975. SFA 20(3).

UTILIZATION OF FISHERY PRODUCTS

75-000343 Dudley, S.; Graikoski, J. T.; Seagran, H. L.; Earl, P. M. (Middle Atl. Coastal Fish. Cent., Milford, CT) SPORTSMAN'S GUIDE TO HANDLING, SMOKING, AND PRESERVING COHO SALMON. NMFS Ext. Publ., Fish. Facts 5. iv + 26p. June 1973. SFA 20(3).

MISC. TECHNIQUES AND EQUIPMENT

75-000344 Gale, W. F.; Thompson, J. D. (Ichthyol. Assoc., Inc., Berwick, PA 18603) A SCUBA DIVER'S LADDER FOR SMALL BOATS. Prog. Fish-Cult. 37 (1): 63-64. Jan. 1975. SFA 20(3).

A single shaft, open-step Scuba ladder for small boats is described. The ladder which mounts on the transom at about a 40 angle is especially useful in lotic water.

REVIEWS, BIBLIOGRAPHIES, ETC.

75-000345 Reintjes, J. W.; Keney, P. M. (Keney, P. M.: Atl. Estuarine Fish. Cent., NMFS, Beaufort, NC 28516) ANNOTATED BIBLIOGRAPHY ON THE BIOLOGY OF THE MENHADENS, GENUS /BREVOORTIA/, 1963-1973. NOAA Tech. Rep. NMFS SSRF-687: 92p. Apr. 1975. SFA 20(3).

A bibliography that consists of 444 references on the classification, distribution, abundance, life history, and ecology of American menhadens, genus /Brevoortia/. Included are references to menhaden published from 1963 through 1973 with those references published prior to 1963 that were omitted from menhaden bibliographies by Reintjes et al. (1960) and Reintjes (1964a). Brief annotations and a subject index are included.

75-000346 Thorson, L. C.; Engett, M. E. (Engett, M.E.: Sci. Pub. Staff, NMFS, 1107 N.E. 45th St., Rm. 450, Seattle WA 98105) FISHERY PUBLICATIONS, CALENDAR YEAR 1974: LISTS AND INDEXES. NOAA Tech. Rep. NMFS CIRC-392. iv + 27p. June 1975. SFA 20(3).

The following series of fishery publications of the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, in calendar year 1974 are listed numerically (with abstracts) and indexed by author, subject, and geographic area: NOAA Technical Report NMFS CIRC (formerly Circular); Data Report; Fishery Facts; NOAA Technical Report NMFS SSRF; and NOAA Technical Memorandum NMFS.

SPORT FISHING TECHNIQUES

75-000347 Hammond, D. L.; Cupka, D. M. (S.C. Wildl. Mar. Resour. Dep., P.O. Box 12559, Charleston 29412) A SPORTSMAN'S FIELD GUIDE TO THE BILLFISHES, MACKERELS, LITTLE TUNAS AND TUNAS OF SOUTH CAROLINA. S.C. Wildl. Mar. Resour. Dep., Charleston, Educ. Rep. No. 3. 32p. 1975. SFA 20(3).

The increasing need for awareness by the angler to the type of fish being landed has pointed to the necessity for an identification guide readily usable by the sport fisherman. The basic external fish anatomy, along with the terminology used, are reviewed. The three families (Istiophoridae, Xiphiidae and Scombridae) are initially divided into four visually similar groups. Each species is treated separately with a blackline drawing followed by a brief description. The distinguishing characteristics which separate a species from other close allies are presented in bold face type. The species of the genus /Thunnus/ are also compared in tabular form to increase ease of identification. Four species of Istiophorids, the Xiphiid specie and sixteen species of Scombrids are covered in this guide.

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